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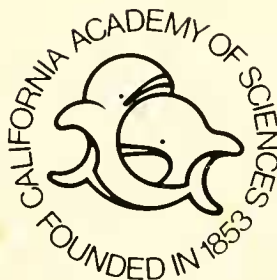
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**A Review of the Deepwater Liparidae (Pisces)
from the Coast of Oregon and Adjacent Waters**

By

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ABSTRACT: Descriptions and distributions are given of 28 species of Liparidae occurring or possibly occurring below 200 m between San Francisco and northern Vancouver Island, with keys for their identification.

Nine genera are treated: *Careproctus*, *Elassodiscus*, *Lipariscus*, *Nectoliparis*, *Rhinoliparis*, *Acantholiparis*, *Paraliparis*, *Odontoliparis*, and *Osteodiscus*. The last two are described as new. Eight new species are described: *Careproctus filamentosus*, *C. microstomus*, *C. oregonensis*, *Osteodiscus cascadiae*, *Odontoliparis ferox*, *Paraliparis paucidens*, *P. megalopus*, and *P. pectoralis*. *Paraliparis caudatus* is shown to be a species of *Elassodiscus*. Second records of four species are reported: *Careproctus longifilis*, *C. ovigerum*, *Paraliparis latifrons*, and *Acantholiparis caecus*. Four known species previously unrecorded from Oregon are reported: *Careproctus longifilis*, *C. ovigerum*, *Paraliparis latifrons*, and *P. rosaceus*. *Paraliparis grandis* is synonymized with *P. rosaceus*. Previously doubtful Oregon occurrence of two species, *Paraliparis dactylosus* and *P. ulochir*, is verified. Four species are included as possibly occurring off Oregon: *Careproctus cypselurus*, *Rhinoliparis barbulifer*, *Paraliparis deani*, and *P. melanobranchus*. Other species treated are *Careproctus melanurus*, *C. gilberti*, *Acantholiparis opercularis*, *Paraliparis cephalus*, and *P. mento*.

Four of the 28 species taken are considered to be pelagic: *Nectoliparis pelagicus*, *Lipariscus nanus*, *Rhinoliparis attenuatus*, and *R. barbulifer*. The benthic species were divided into two groups based on their depth distributions. The slope group of 13 species occurs between 200 and 2200 m; the abyssal plain group of 11 species occurs between 2200 and 3600 m.

Certain morphological characters are depth related. Slope-group species tend to have more pectoral and caudal rays, and more pyloric caeca than deep-living species; they have pale skin, and darkly pigmented stomachs; the opposite is true in the abyssal group. The more primitive genera of deepwater liparids do not occur at lesser depths in the study area than do more derived genera. Within genera, primitive species occur in shallower water than derived ones.

INTRODUCTION

The Liparidae is a family of cottoid fishes distinguished (with the Cyclopteridae) by the presence of a ventral disk derived from the pelvic fins (although the disk may be secondarily lost in some genera), but differentiated from the Cyclopteridae by the structure of the hyomandibular, preoperculum, interoperculum, suborbital stay, cleithrum, supra-cleithrum, pelvic girdles and other osteological features. The internal anatomy of the two families also differs in the length and pattern of intestinal coiling (Ueno 1970).

This is a study of newly available liparid material from bathyal and abyssal depths off Oregon and adjacent waters (Fig. 1). Its goals are the identification of known species, description of new species, and provision of keys for the identification of all species presently or likely to be found below 200 m in the study area.

Of the three most common families of deepwater benthic fishes off the Oregon coast and in adjacent waters, the taxonomy of only one, the Macrouridae, is well known (Iwamoto and Stein 1974). The remaining two, the Liparidae and Zoarcidae, are poorly known because of the natural rarity of most of their deepwater species and the difficulty of adequately sampling deep bathyal and abyssal waters. Members of the School of Oceanography of Oregon State University have been sampling the continental slope and abyssal plain off Oregon since 1962. Among the fishes captured during this period have been many unknown liparids, present in small numbers, and often in poor condition. Only recently has the number of specimens collected from this area increased to a point where adequate study is possible.

Most liparid literature consists of descriptions of new genera and species. There have been two reviews of the family: "The Discoboli" (Garman 1899), and "Revision of the fishes of the family Liparidae" (Burke 1930). The scope of "The Discoboli" was severely circumscribed by the limited liparid collections available at the time. Only 20 species in three genera of liparids were known to Garman. By 1930, many new species and genera had been described, making a thorough review and revision of the family imperative. Burke (1930) was more fortunate in having available for examination adequate specimen series of many species. He discovered and utilized many of the characters commonly used in liparid taxonomy at present. Furthermore, he drew conclusions

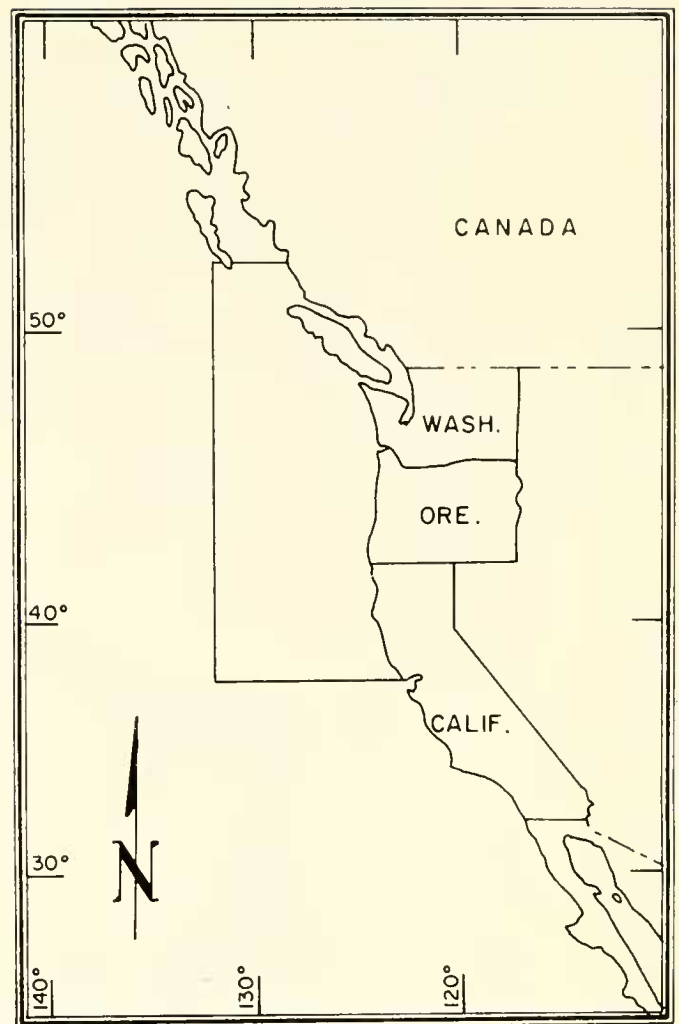


FIGURE 1. Coast of Oregon and adjacent waters, showing limits of study area.

about phylogeny, zoogeography, depth-related morphological trends, and the relationship between morphology and mode of life. His principles and methods provided the basis for much of the work included here. However, not many more specimens of each species of deep-sea liparids were available to Burke than were available to Garman. The only specimens of some species available to Burke were those with which Garman had worked. As a result of the relatively low number of deepwater collections and lack of intensive sampling of small areas, these studies, and the literature in general, include comparatively little information about deep-sea liparids.

Several local ichthyofaunal studies in the North Pacific since 1930 are important contributions to knowledge about liparids. Most noteworthy is *Fishes of the Sea of Okhotsk* (Schmidt 1950) which presents hypotheses concerning the origin of the endemic faunas, keys, descriptions of new species, and ecological information on a large number of species. Andriashev (1954) included keys and zoogeographic information for

four genera and nine species of liparids captured in northern seas of the USSR, and commented on the need for a revision of the Liparidae.

Studies including eastern North Pacific Liparidae are those of Schultz (1936), with keys to all species then reported from Oregon, Washington, and British Columbia; Clemens and Wilby (1949, 1961), including keys and descriptions for all species then known from British Columbia; and Wilimovsky (1954, 1958), with a list and keys to Alaskan fishes.

Grinols (1965), in an unpublished thesis, reported new northeast Pacific records for *Careproctus cypselurus*, *C. gilberti*, *Paraliparis cephalus*, *P. dactylosus*, and *P. ulochir*. These records were never formally published, nor was any corroborating evidence given to support the identifications. I have been unable to determine which specimens Grinols referred to, and he could not supply the information. Consequently, I consider these records unverifiable. Unfortunately, Quast and Hall (1972) and others have cited Grinols, entering these unverified, unpublished records in the published literature. Alton (1972) has also listed new Oregon records of two species of liparids, the first of which is also a second record: *Paraliparis melanobranchus* and *Elassodiscus caudatus* are listed as occurring off Oregon. These records are also unverified in that no information is given about the specimens.

Hart (1973) complements Clemens and Wilby (op. cit.) with expanded keys, descriptions and some ecological information. Although the preceding references are useful for identification of shallow-water (less than 200 m) liparids and a few deepwater species, they are of little assistance in the identification of most deepwater species.

DISCUSSION

The family Liparidae has an extremely wide vertical and horizontal distribution; species are known from estuaries to depths greater than 7000 m (*C. amblystomopsis* Andriashev, 1955). The benthic liparid species examined in this review are distributed between 200 and 3585 m, with any given depth being within the range of at least one species. Analysis of depth distributions clearly shows two groups of species (Fig. 2). The first group consists of those species found between 200 and about 2200 m, the second of species between 2200 and 3600 m. The first group may be further subdivided at 1500 m, and the second at 3000 m. These subdivisions are tentative; the first

major subdivision is represented by few specimens; the second may be a sampling artifact. There is apparently no clear predominance of advanced genera in deep water, although this does not conflict strongly with the hypothesis of Burke (1930:34), who suggested a shallower occurrence of more primitive genera. However, a relationship between depth and the phylogenetic position of species within certain genera is present; more primitive species occur at shallower depths in both *Careproctus* (*C. melanurus*, *C. cypselurus*) and *Paraliparis* (*P. dactylosus*), while the deepest-living species (*C. longifilis*, *C. filamentosus*, *P. megalopus*) possess the most advanced traits.

Briggs (1974:391) states that "apparently, no *Careproctus* species typically inhabit the abyssal plain"; at least five of the species off Oregon (*C. longifilis*, *C. microstomus*, *C. oregonensis*, *C. filamentosus*, *C. ovigerum*) are found only on the plain.

Some morphological trends are related to depth (Table 1). Characters which show such trends are skin color, number of pectoral fin rays, stomach color, number of pyloric caeca and tooth shape. Most of the species in the upper (slope) group are pale, and many have large pectoral fins and lobed teeth. All have pyloric caeca, some in large numbers (*C. melanurus*, *C. cypselurus*, *P. dactylosus*, *E. caudatus*). In six species (*C. gilberti*, *E. caudatus*, *P. melanobranchus*, *P. deani*, *P. cephalus*, *P. ulochir*) the stomach is black externally. In contrast, most of the species composing the abyssal plain group are darkly colored, have reduced, deeply notched pectoral fins (except *C. ovigerum*), and simple teeth (with the exception of *C. oregonensis*, which has the shallowest distribution in the group). In all, pyloric caeca are few or even absent (*Osteodiscus cascadae*, *Acantholiparis opercularis*). It may be significant that *A. caecus*, which has pyloric caeca, apparently has a distinctly shallower distribution than *A. opercularis*. Only one species (*P. megalopus*) has a black stomach. Peritoneum color may be depth related, but the evidence is inconclusive. Two slope species (*P. gilberti*, *P. deani*) have pale peritoneums, while only one abyssal species (*C. ovigerum*) has a non-black peritoneum.

Rass (1964) discussed depth-related differences occurring among species of *Careproctus*. He observed that darker colored species occurred predominantly at abyssal depths (incor-

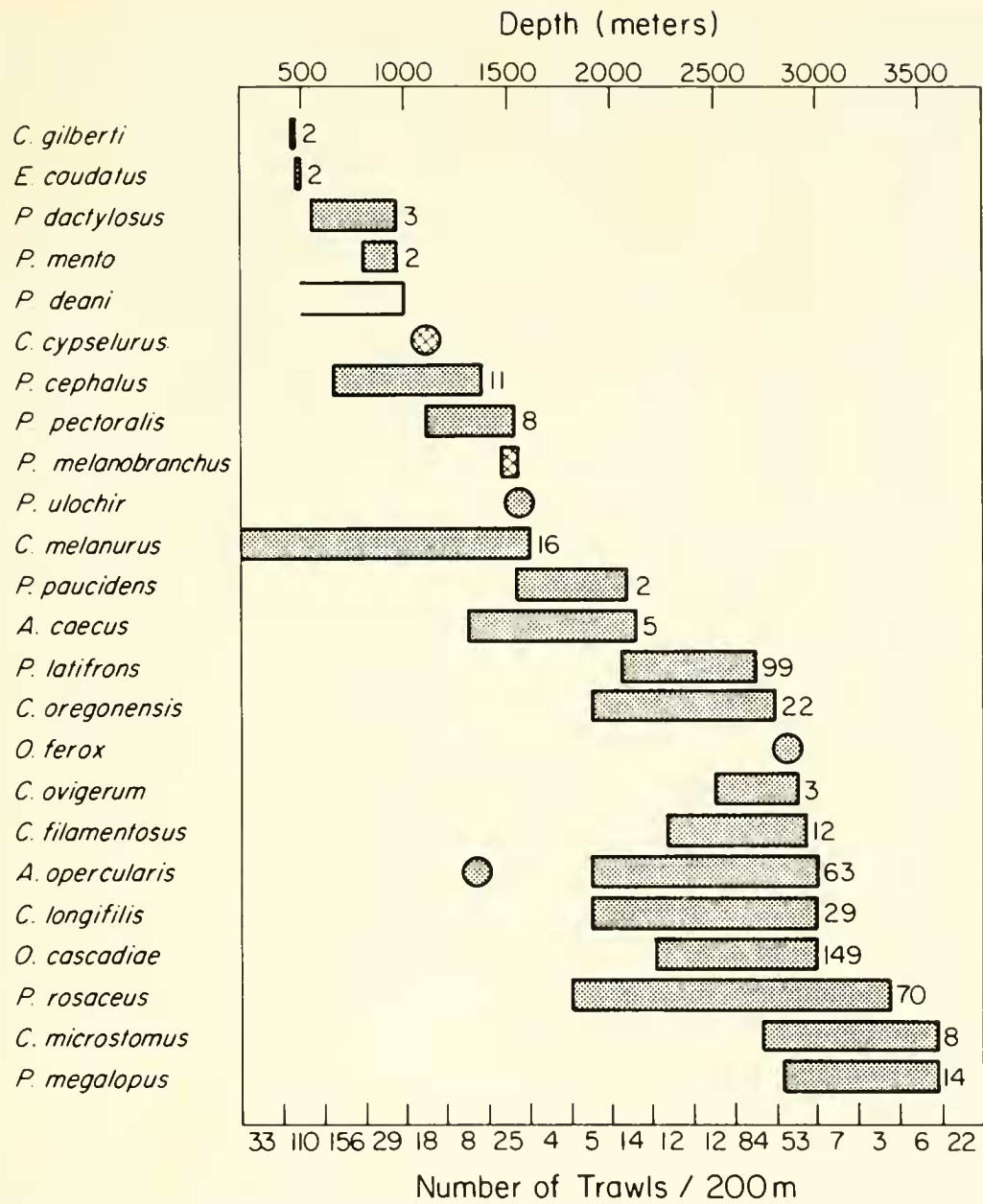


FIGURE 2. Depth distribution of benthic liparid species below 200 m off Oregon, and number of trawls per 200-m depth increment. Blanks: species likely to occur off Oregon; circles: single captures; hatched areas: unverified records. The number of specimens examined from the study area is next to the distribution of each species.

rectly including the pale *C. ovigerum*), and that these species had dark peritoneums. He did not consider external stomach pigmentation, which apparently does not become darker with increasing depth. My only present explanation for the predominance of dark stomachs at shallower depths is that bioluminescence of possible prey organisms may be at a peak at intermediate depths (Clarke and Hubbard, 1959, found bioluminescence increasing to 1000 m, and decreasing below that point), and is better masked by black stomachs than by black peritoneums.

The horizontal distribution of many of the species in the study area is unknown. Of those previously recorded elsewhere, many have wide distributions. Most are much more widely dis-

tributed longitudinally than latitudinally, especially slope species restricted to a geographically narrow band along the continental slope (*E. caudatus*, *C. gilberti*, *P. mento*, *P. cephalus*, *P. deani*, and *P. dactylosus*). For abyssal plain species (*C. longifilis*, *P. rosaceus*, *P. latifrons*) this may be a sampling artifact resulting from lack of samples from farther offshore. *Nectoliparis pelagicus*, a pelagic species, is very widespread, occurring in neritic waters around the North Pacific from Japan to central California. Shallower-living benthic species are generally considered to be more limited in horizontal distribution (Hesse, Allee, and Schmidt 1951:97); however, of the relatively shallow (less than 600 m) species discussed here (*C. gilberti*, *P. dac-*

TABLE 1. MORPHOLOGICAL CHARACTERS AND DEPTH RANGES OF DEEP-SEA BENTHIC LIPARIDS. ABBREVIATIONS: S—simple; L—lobed; M—mixed; P—pale; D—dark; B—black; Str—streaked.

| Species | MORPHOLOGICAL CHARACTERS | | | | | | | | | | | Depth (meters) |
|--------------------------|--------------------------|--------------|-----------------------|----------------|------------------|----------------|---------------|----------------|---------------|--------------------------|-----------------------|-------------------|
| | Dorsal rays | Anal rays | Pec- toral rays | Caudal rays | Pyloric caeca | Tooth shape | Body color | Mouth color | Gill color | Perito- neum color | Stom- ach color | |
| <i>C. gilberti</i> | 49-55 | 44-48 | 30-33 | 8-9 | 10-12 | S | P | D | D | P | B | 468-472 |
| <i>E. caudatus</i> | 49-55 | 45-50 | 27-29 | 9 | ca.14 | L | P | P | P | B | B | 479-500 |
| <i>P. dactylosus</i> | 54-56 | 49-51 | 28-30 | 8 | 17-22 | L | P | B | B | B | P | 550-960 |
| <i>P. mento</i> | 55-59 | ca.49-51 | 16-18 | 5 | 6-8 | S | P | D | D | D | P | 800-960 |
| <i>P. deani</i> | 56-57 | 44-48 | 18-22 | ca.6 | ca.8 | L | P | P | P | P | B | ?500-1000 |
| <i>C. cypselurus</i> | 58-62 | 53-56 | 34-36 | 10 | 29-32 | L | D | D | D | D | P | 1097 |
| <i>P. cephalus</i> | 50-57 | 44-51 | 14-16 | 4 | 6-10 | S | P | P | D | B | B | 640-1372 |
| <i>P. pectoralis</i> | 55-58 | 49-52 | 29-32 | 7-8 | 9-10 | S | D | B | B | B | P | 1097-1536 |
| <i>P. melanobranchus</i> | 60 | 53 | 17 | 4 | 7 | S | P | B | B | B | B | 1463-1554 |
| <i>P. ulochir</i> | ca.69 | 61 | 24 | 4 | ca.8 | S | B | B | B | B | B | 1554 |
| <i>C. melanurus</i> | 53-57 | 47-51 | 27-33 | 9-11 | 20-31 | M | P | D | D | D | P | 200-1600 |
| <i>P. paucidens</i> | 58-60 | 53 | 19-24 | 6-8 | 8 | S | D | D | D | B | P | 1536-2080 |
| <i>A. caecus</i> | 48-52 | 43-45 | 21 | 8 | 4-6 | S | D | D | D | D | D | 1554-2122 |
| <i>P. latifrons</i> | 54-57 | 48-50 | 21-24 | 5-6 | 6-10 | S | D | B | B | B | P | 2048-2706 |
| <i>C. oregonensis</i> | 61-67 | 55-57 | 19-23 | 7-8 | 8-11 | M | D | B | B | B | P | 1900-2818 |
| <i>O. ferox</i> | 51 | 46 | 17 | 6 | 7 | S | B | B | D | B | P | 2884 |
| <i>C. ovigerum</i> | 43-45 | 34-37 | 31-34 | 11 | 16-19 | S | P | P | P | D | P | 2510-2904 |
| <i>C. filamentosus</i> | 58-63 | 52-55 | 21-24 | 7-8 | 6-9 | S | B | D | D | B | P | 2265-2940 |
| <i>A. opercularis</i> | 45-52 | 38-47 | 20-23 | 8 | 0 | S | D | D | B | B | P | 2519-2997 |
| <i>C. longifilis</i> | 50-54 | 44-48 | 17-23 | 8-9 | 10-13 | S | B | B | B | B | Str | 1900-2997 |
| <i>O. cascadiae</i> | 47-52 | 40-44 | 20-25 | 6-7 | 0 | S | B | B | B | B | Str | 2195-3000 |
| <i>P. rosaceus</i> | 57-64 | 54-59 | 18-22 | 6-8 | 6-9 | S | D | D | B | B | P | 1799-3358 |
| <i>C. microstomus</i> | 61-67 | 54-60 | 22-27 | 8 | 5-7 | S | B | B | B | B | P | 2721-3585 |
| <i>P. megalopus</i> | 66-71 | 63-65 | 16-19 | 4 | 6-8 | S | D | B | B | B | B | 2830-3585 |

tylosus, *E. caudatus*, *P. deani*, *C. melanurus*), the first occurs from the Bering Sea to Oregon, the second from the Bering Sea to California, the third from southeast Alaska to Monterey, California, the fourth from southeast Alaska to California, and the last from Alaska to southern California. Deeper species (*P. rosaceus*, *P. latifrons*, *C. longifilis*) have the widest ranges, however, and will probably be reported outside their presently known ranges in the future. The western ranges of all but three species of abyssal liparids (*P. rosaceus*, *P. megalopus*, *C. microstomus*) appear to be limited by the East Pacific Rise. Only these three species occur on Tufts Abyssal Plain, and they occur there very rarely. The abrupt lower distributional limits of many upper abyssal plain species may be a sampling artifact created by the East Pacific Rise, an area where it is not possible to bottom trawl.

Four species treated here are considered to be pelagic. *Nectoliparis pelagicus* and *Lipariscus nanus* are definitely pelagic and have been captured in mid-water trawls between Monterey Bay and northern Vancouver Island, British Colum-

bia. *Rhinoliparis attenuatus* and *R. barbulifer* were long considered to be benthic (Burke 1930:4), but Schmidt (1950:216) considered the second to be definitely pelagic. The present study indicates that if pelagic, they are probably benthopelagic, as all the Oregon State University specimens were captured in bottom trawls. Their horizontal distribution is broad; for example, *R. barbulifer* is known from around the North Pacific above latitude 40°N.

The liparids are the most speciose family of benthic fishes off the coast of Oregon below 200 m; there are apparently about twice as many species as in the next most speciose family, the zoarcids. Andriashev (1953) considered the liparids to be a secondary deep-sea family, citing the absence of *de novo* modifications to deepwater life, increased development of sensory canals, reduction of the ventral sucker, and modification of the pectoral fin in deeper-living species. He also stressed the rather restricted distribution of species, a characteristic of secondary deep-sea fishes which this study does not support. As secondary deep-sea fishes, the

liparids must have invaded deep water at least once since the Tertiary (Andriashev 1953). The presence of *Careproctus ovigerum* in deep water is evidence that the speciosity present off Oregon is partially the result of repeated invasions from shallow water. *Careproctus ovigerum* is apparently a primitive *Careproctus*, of a pale color, having a low number of vertebrae, short dorsal and anal fins, large, well developed pectoral and caudal fins, and an extremely large, functional disk. Its most advanced characteristic is its simple, sharp, canine teeth. Its morphology contrasts markedly with that of other abyssal *Careproctus*, which are darkly pigmented, and which have high numbers of vertebrae, long vertical fins, reduced pectoral fins, caudal fins, and disks.

Another possible reason for liparid speciosity is highly specialized feeding habits. At the present time, some evidence supports the hypothesis that deep-sea liparids are highly selective feeders; a cursory study of stomach contents of *P. rosaceus* revealed that all specimens with any identifiable stomach contents contained holothurians only. Stomach contents of other species have not been examined. I expect that a feeding-habits study will show a high degree of selectivity among species which live in areas where many liparid species are present (such as Cascadia Abyssal Plain).

MATERIALS

Most of the specimens examined in this study were collected by the School of Oceanography, Oregon State University (OSUO). All specimens collected by OSUO were fixed in 10% Formalin-seawater solution and preserved in 45% isopropanol. Specimens were collected by 6.7-m semi-balloon otter trawl, 3-m beam trawl (Carey and Heyamoto 1972), and 1.8- and 2.4-m Isaacs-Kidd mid-water trawls (MT). To August 1975, 601 hauls by otter trawls (OT, OTB) and beam trawls (BMT) were made below 200 m by OSUO vessels. Of these, 328 have been between 200 and 1000 m, 60 between 1000 and 2000 m, and 213 between 2000 and 4000 m. More than 2100 mid-water trawls have been made between the surface and 2000 m.

Other specimens have been examined from, and are on deposit at, the U.S. National Museum (USNM), California Academy of Sciences (CAS), Museum of Comparative Zoology of Harvard University (MCZ), Department of Fisheries and Wildlife, Oregon State University (OS),

California State University at Humboldt (CSUH), Moss Landing Marine Laboratories (MLML), National Museum of Canada (NMC), British Columbia Provincial Museum (BCPM), University of Washington, College of Fisheries (UW), Virginia Institute of Marine Sciences (VIMS), Institute of Fisheries, University of British Columbia (UBC), and Auke Bay Biological Laboratory (ABBL). Specimens from Stanford University (SU) are on deposit at CAS.

METHODS

Liparids are difficult to study. They are easily damaged because they have soft bodies and poorly calcified bones. The present method of preservation is fixation in 10% buffered Formalin, and storage in 70% ethanol. Many of the older specimens I have examined have become extremely brittle, and cannot be handled without damage to them. The majority of specimens are at least partially skinned and have damaged fins. Their morphology is very difficult to study because the specimens are easily crushed or otherwise distorted. Some measurements, such as orbit diameter, are virtually impossible to make accurately because of the very weak cephalic ossification and irregular orbital shape. Most deepwater species have very loosely attached, fragile skin, which is probably separated (in life) from the musculature of the fish by a layer of gelatinous tissue or liquid. Consequently, many measurements (in preserved specimens) of depth, head width, etc. are probably different from the actual dimensions of the living animal. Furthermore, the degree to which these layers are damaged severely affects the variability of measurements of specimens. The fragile skin also makes it difficult to study color and patterns of cephalic and rudimentary pores.

CHARACTERS OF TAXONOMIC VALUE

The shape of jaw teeth has been used as an important means of differentiating genera and species (Burke 1930). Liparids may have trilobed, cross-shaped, arrow-shaped, or lanceolate teeth. Tooth shape may vary with tooth size and the age of the individual (Fig. 3). Many species have teeth of several different shapes at a given time or at different times during their life. Generally, the largest teeth in the jaws of an individual show the dominant shape most strongly. Tooth shapes are useful in separating groups of species, but usually not closely related species.

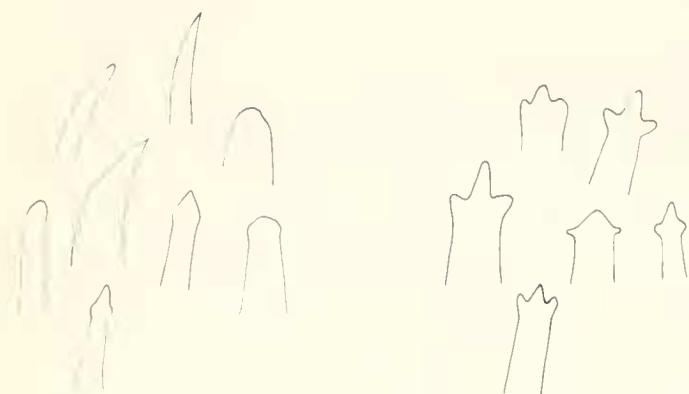


FIGURE 3. Typical simple teeth (left) and lobed teeth (right) of liparids.

The position of the upper pectoral ray in relation to the head may also be useful in differentiating among groups of species within a genus. Ideally, the more dorsal the position of the pectoral fin, the more primitive the species. Burke (1930:39) felt that the genus *Liparis*, with a low number of vertebrae, trilobed teeth, short dorsal and anal fins, and dorsal notch is probably most primitive. The species of *Liparis* and *Careproctus* have pectoral fins consistently located high on the side of the body. However, *Paraliparis* species vary distinctly in the position of their pectoral fins. The position of the upper pectoral ray should be constant within a species because it is involved in the phylogeny of the species. In fact, this character is most useful in *Paraliparis* because interspecific variation in pectoral fin position in other genera is relatively low, and intraspecific variability does exist. Most liparid species are so poorly ossified that battering will move the entire pectoral girdle within the body. Within the genus *Paraliparis* the extremes of pectoral fin position are greater, so that some species, such as *Paraliparis mento*, can be distinguished from all others on the basis of pectoral fin position.

Dorsal and anal fin-ray counts have been little utilized in differentiating between species for four reasons: first, their high number makes them difficult to count; second, in many species, the anterior rays are poorly ossified and/or completely buried in flesh or gelatinous tissue and, hence, they may be accurately counted only by radiography; third, specimens of attenuate species commonly lose posterior dorsal and anal rays when captured; fourth, the number of dorsal rays in some species may vary by as many as seven, resulting in a great overlap among closely related species.

Pectoral fin-ray numbers were used extensively by Burke (1930), Gilbert and Burke (1912a, 1912b) and others to distinguish species. These authors considered a difference of one or two rays to be a significant difference between species. I have found that the pectoral fin-ray number within a species may vary widely and that the extremes of counts in different species often overlap, although the number of rays in most individuals of those species may not. Apparently, pectoral fin-ray counts of shallow-water species are less variable than those of deepwater species I examined; Burke's (1930) counts in many shallow-water species did not vary by more than one. In some instances, such as in *Careproctus melanurus*, my counts conflict with his. Possible causes of the discrepancies may be geographic-, size-, or age-related variation in the count. Despite such problems, pectoral fin-ray number is one of the most useful characters for distinguishing between species of liparids.

Caudal fin-ray number is much more constant within a species than pectoral ray number. Burke (1930:47) considered principal caudal rays to be "full-length rays" reaching the end of the caudal fin. Utility of his definition is limited because the tip of the caudal fin is often lost, and some otherwise indistinguishable caudal rays may not reach the end of the fin. Burke's definition eliminated "rudimentary" (procurrent) caudal rays from caudal counts. These procurrent rays (Fig. 4) are most common in the genus *Liparis*, but they do occur in other genera although in fewer numbers. Most of the species I examined have one or two. I have not included procurrent rays in counts of the rays of the median fins or the caudal fin and have defined the procurrent rays by the position of their bases on the hypurals (Fig. 4). This definition is more precise than those based on external appearance, because in advanced liparids (some *Careproctus*, *Paraliparis*, *Osteodiscus*, *Odonotoliparis*) the procurrent rays may not be externally distinct from dorsal and anal rays.

Primitive liparids (I examined *L. mucosus* Ayres and *L. pulchellus* Ayres) have a caudal fin distinctly separated from the median fins by one or two neural and hemal spines which do not bear pterygiophores or rays. *Liparis mucosus* has four to five easily recognizable procurrent caudal rays, both epi- and hypocordally. Although some of these rays are not segmented, they are not true spines, as they are easily split. *Liparis pulchellus* Ayres, a more advanced species, has externally

confluent dorsal, caudal, and anal fins. Radiographs and cleared-and-stained specimens show that the clear gap present in *L. mucosus* is absent in *L. pulchellus*. The number of procurent rays has been reduced in *L. pulchellus* to one dorsal unsegmented ray, which is distinctly based on the larger, more posterior of the two epurals present. The first pre-ural centrum bears a neural spine which is associated with, but may not actually support, the posteriormost dorsal ray. The hemal spine of this centrum has become the parhypural and does not support a ray. A radiograph of the caudal region of a specimen of *C. ovigerum* (CAS 32345, 431 mm SL) shows two dorsal procurent rays, the anterior of which is extremely reduced and appears to be supported only by the fin membranes or by cartilage not visible in the radiograph. The posterior procurent ray is well developed, segmented, and based on the antero-dorsal surface of the urostyle. A radiograph of the holotype of *C. ovigerum* (USNM 48622, 318 mm TL) does not show the anterior procurent ray. I believe this shows that it is being lost. The structure of the caudal fin of *C. longifilis* is typical of most species I examined. It usually has one procurent ray dorsally and occasionally a ventral one; it lacks epurals, although radiographs of some specimens show traces of ossification in the epural position. There is a distinctly wider gap present between the posteriormost dorsal and anal rays and the procurent ray(s) than between the dorsal and anal fin-rays themselves. *Rhinoliparis attenuatus*, which has the most reduced caudal of any known liparid (two principal rays), lacks procurent rays. The trend clearly shown by the specimens examined is one of progressive loss of the elements intermediate between the hypural plate and the vertebra bearing the posteriormost median-fin elements.

Internal characters have been used in classifying the Cyclopteridae (Ueno 1970), but less use has been made of them in classifying the Liparidae. Matsubara and Iwai (1954) discussed the phylogenetic significance of the alimentary canal shape and internal effects of the position of the anus in Liparidae. In their opinion, posterior position of the anus and reduced amount of intestinal coiling were primitive liparid characters. The number of pyloric caeca and the pigmentation of the stomach are the most useful internal characters in the Liparidae, partly because they are seldom damaged. The biological implications of the number and nature of the pyloric caeca are

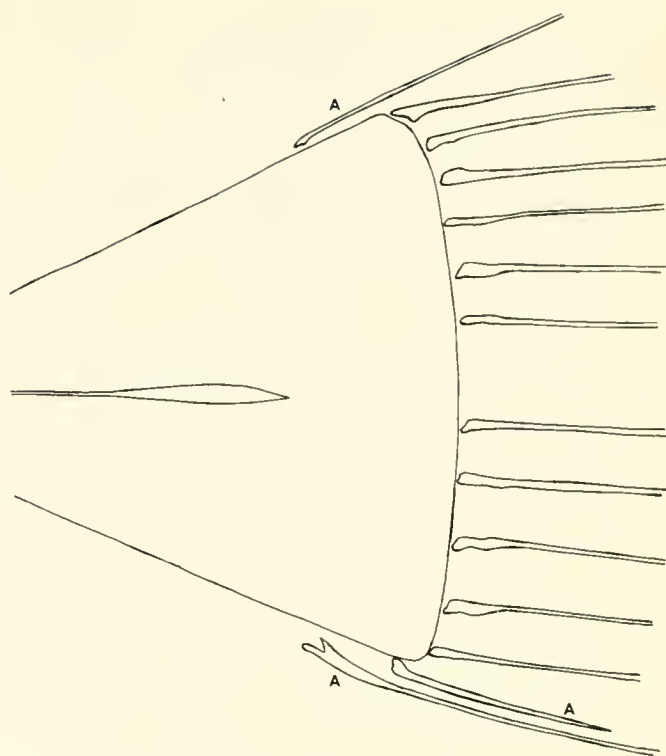


FIGURE 4. Diagram of a typical caudal skeleton of a liparid showing positions of the principal and procurent (A) caudal rays on the hypural plate.

not clear; most deepwater species have between five and ten, although at least two species, *Osteodiscus cascadiae* and *Acantholiparis opercularis*, have none. Stomach color in specimens I examined is either black or pale, with two exceptions: *Careproctus longifilis* and *Osteodiscus cascadiae*, in which the stomach is streaked. *Careproctus longifilis* is the only species I examined in which the stomach color varied. There is no evidence to indicate that stomach color within the other species investigated varies significantly, even in species such as *C. melanurus*, which has a wide longitudinal and vertical range.

All liparids possess a prominent cephalic canal system with cephalic sensory pores. The cephalic pores were classified by Burke (1930:8) into nasal, mandibular, maxillary, and suprabranchial series (Fig. 5). They were further discussed by Matsubara and Iwai (1954). The one or two nasal pores are easily confused with the nares in species with non-tubular nostrils, and with the mandibular pores. There are five to seven maxillary pores in a series "extending along the lower margin of the snout and eye to above the posterior margin of the eye" (Burke 1930:9). The six or seven mandibular pores parallel the maxillary series to a point posterior to the orbit. There are only one or two suprabranchial pores, located

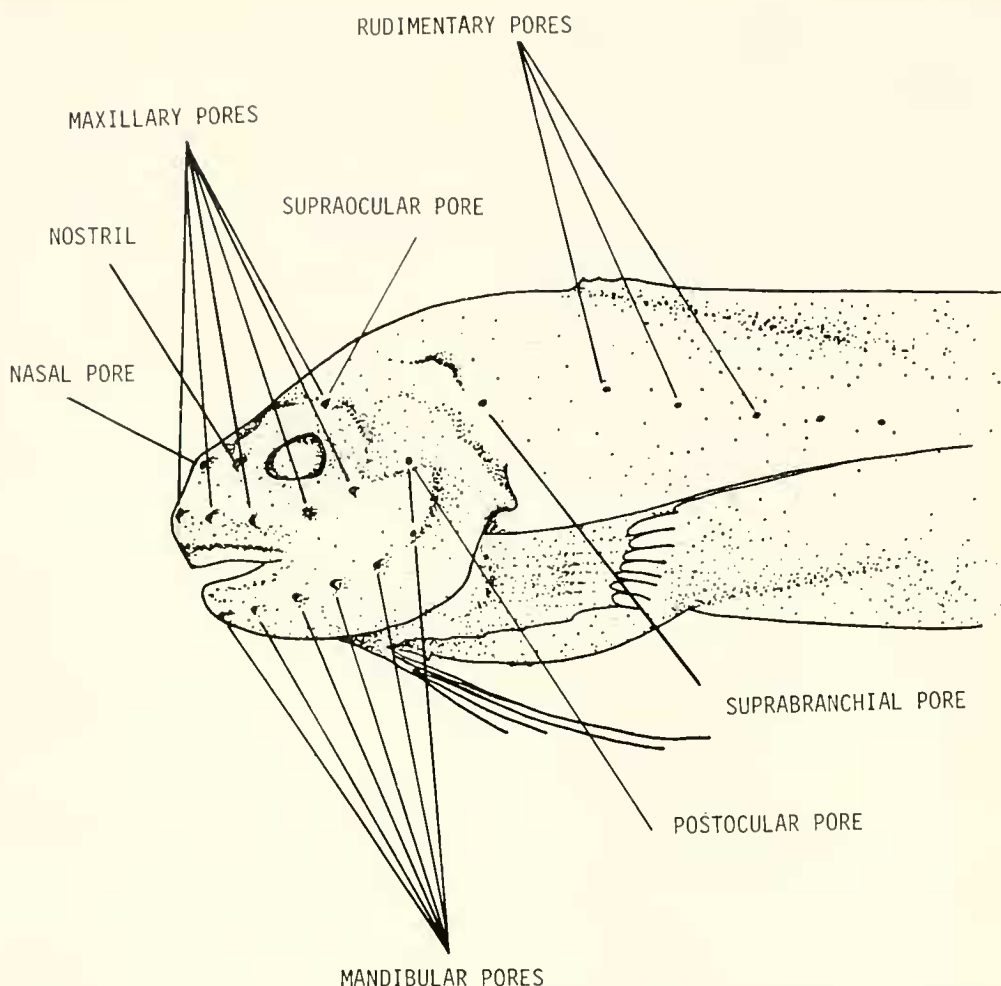


FIGURE 5. Arrangement of cephalic and rudimentary pores on a typical deep-sea liparid.

dorsal to the operculum. The cephalic pores may be minute or very large; in most species considered here, the posteriormost (or supraocular) pore of the maxillary series and the supra-branchial pore(s) are often distinctly smaller than the others. In *P. latifrons*, all pores are very large. In some species, the symphyseal pair of mandibular pores is also smaller.

Rudimentary pores as described by Burke (1930:9) occur in species of *Liparis*, *Careproctus*, *Paraliparis*, *Osteodiscus*, and *Odontoliparis*. Occurrence of these pores was discussed by Cohen (1968), who predicted their occurrence on many species of *Paraliparis*, a prediction which I have found to be correct. Their significance in liparid classification is unknown. If present, some rudimentary pores are always associated with the lateral line, although in *C. ovigerum* they also occur on other parts of the body. They are probably associated with the vibration-sensing system.

The pattern, size, and number of pores are probably species specific. At the present time, the poor condition of much of the available material prevents analysis of the relationships of

liparid species on these bases. When better specimens become available, such an analysis will be possible.

Prickles have also been used to distinguish species. In at least one species, *Liparis inquilinus*, prickles are a sexually dimorphic character and are not present on females (Able 1973). Although this dimorphism may not obtain in all species possessing prickles, caution should nevertheless be used when utilizing this character for taxonomic purposes.

The disk, when present, is the most prominent external feature of this family. It has been used as a character of importance at the generic and specific level. Its shape and size have been used extensively to differentiate species (Schmidt 1950; Gilbert and Burke 1912b, and others). However, I believe disk characters have been overutilized. The degree to which the disk is cupped, and the folding of its margins, partially depends upon the tetany of the disk musculature resulting from death and preservation. Furthermore, the width of its margin and the shape of its edge are variable within species, although not to a great extent. Among species similar in disk size

and general disk structure, the amount of variation present renders disk characters unreliable.

With the following exceptions, measurements and counts are made according to Hubbs and Lagler (1964). Where possible all measurements and counts were made on the right side due to the necessity of dissecting fins for counts. Maughan (1974), investigating the related Cottidae, showed that no differences in counts result from doing so. Only specimens from which measurements and counts were taken are included in the material examined sections.

MEASUREMENTS

Standard length measurements (SL) have been rounded to the nearest millimeter because of the softness of the snout, which makes accurate measurement difficult.

Upper pectoral fin-lobe length: from base of dorsalmost ray to posteriormost tip.

Disk length: length from anterior edge to posterior edge; in many instances where the disk is deeply cupped, it is necessary to unfold the edges.

Disk width: greatest distance between unfolded lateral edges.

Snout to disk: tip of snout to anteriormost edge of disk, with disk spread but not distorted by stretching.

Mandible to disk: anterior of mandibular symphysis to anteriormost edge of spread disk.

Disk to anus: from posterior edge of spread disk to center of anal orifice.

COUNTS

Counts are given as the mode and, in parentheses, the range. Morphometric ratios are given in percentage of standard length (SL) or head length except in the keys, where they are given as dividends. The average value is followed (in parentheses) by the range. Where the number of specimens examined is too few for a significant mode or average, only the ranges are given.

Dorsal fin rays: counted using radiographs where possible; all rays included, both buried and free.

Anal fin rays: counted using radiographs where possible; all rays included, both buried and free.

Principal caudal fin rays: only rays with their bases directly on the posterior margin of the hypural plate are included. Procurrent caudal rays do not meet this requirement (Fig. 4).

Pectoral fin rays: base of fin must be dissected

for rays to be counted accurately; counts are of all rays, including rudimentary ones where present. The first ray of the fin is the most ventral.

Cephalic pores: series as described by Burke (1930:9), in nasal, maxillary, mandibular, and suprabranchial series. Number of pores in each series given in above order, separated by hyphens.

DEFINITIONS

Opercular flap: the portion of the opercle extending posterior to the dorsal and ventral points of attachment to the body.

Rudimentary pectoral fin ray: a ray which either does not reach outline of fin or is present only as a stub on pectoral girdle.

Simple tooth: a tooth which does not have more than one cusp; sometimes slightly swollen laterally, but never with sharp lateral cusps (Fig. 3).

Lobed tooth: a tooth with distinct lateral cusps (Fig. 3).

Procurrent caudal ray: a ray apparently on the hypural plate, but with the anteriormost point of its base not aligned with those of the other caudal rays or noticeably curved (Fig. 5).

Imperfect disk (of two types):

Skeletal disk—a disk in which the normal fleshy rim and central musculature are absent. The bony structure is entirely visible, covered only by a thin layer of skin (Fig. 9).

Rudimentary disk—a disk in which either the supporting rays are absent, or the fleshy rim is divided into lobes.

Normal disk: a disk in which there is an outer fleshy rim with a complete margin, surrounding a central segmented area of well developed muscles.

Postocular cephalic pore: if present, the pore of the mandibular pore series lying directly posterior to the eye.

Supraocular cephalic pore: if present, the pore of the maxillary pore series lying above a horizontal through the upper eye margin.

TAXONOMIC SECTION

KEY TO THE GENERA OF LIPARIDAE
INCLUDED IN THE PRESENT WORK

- 1a. Disk present 2
- 1b. Disk absent 4
- 2a. Disk perfect, fleshy, margin entire *Careproctus* Krøyer (p. 10)
- 2b. Disk imperfect; lobed or skeletal 3

- 3a. Disk skeletal, supporting rays produced posteriorly . *Osteodiscus* new genus (p. 24)
- 3b. Disk imperfect, margin lobed, lacking bony elements
 ... *Elassodiscus* Gilbert and Burke (p. 26)
- 4a. Branchiostegal rays five 5
- 4b. Branchiostegal rays six 6
- 5a. Gill slit wholly above uppermost pectoral fin ray *Lipariscus* Gilbert (p. 29)
- 5b. Gill slit wholly below upper pectoral ray
 ... *Nectoliparis* Gilbert and Burke (p. 31)
- 6a. Barbels or papillae on snout 7
- 6b. No barbels or papillae on snout 8
- 7a. Barbels present on snout, teeth small, either trilobed or simple, not much recurved *Rhinoliparis* Gilbert (p. 32)
- 7b. Large papillae present on snout and mandible between cephalic pores, teeth large, simple, very sharp and recurved
 *Odontoliparis* new genus (p. 33)
- 8a. Laterally directed opercular spine present
 . *Acantholiparis* Gilbert and Burke (p. 35)
- 8b. Laterally directed opercular spine absent *Paraliparis* Collett (p. 37)

Genus *Careproctus* Krøyer

Careproctus KRØYER, 1861:253 (type-species *Careproctus reinhardi* Krøyer, 1861, by monotypy).
Enantioliparis VAILLANT, 1888b:22 (type-species *Enantioliparis pallidus* Vaillant, 1888, by monotypy).
Bathyphasma GILBERT, 1895:447 (type-species *Bathyphasma ovigerum* Gilbert, 1895, by monotypy).
Prognurus JORDAN AND GILBERT, 1898, in JORDAN AND EVERMANN 1898: 2866 (type-species *Prognurus cypselurus* Jordan and Gilbert, 1898, in Jordan and Evermann 1898, by original designation).

The following is Burke's (1930:95) diagnosis of the genus:

"Disk present, perfect; nostril single; teeth trilobed to simple; suprabranchial pores usually 2 [sic]; dorsal notch present or absent; pyloric caeca present or absent; pseudobranchiae absent; branchiostegals 6 [sic]."

The genus *Careproctus* was erected by Krøyer (1861) because of the reduced disk and the anterior position of the anus (and the resulting internal changes). *Enantioliparis* Vaillant (1888b), from Tierra del Fuego was differentiated from *Careproctus* on the basis of its free, prolonged, lower pectoral fin rays. Jordan and Evermann (1896) divided the known species of *Careproctus* into four subgenera: *Careproctus*,

Caremitra (*simus* Gilbert), "distinguished by the short, deep body and blunt head"; *Allochir* (*melanurus* Gilbert), "distinguished by the entire pectoral fins, without trace of notch"; and *Allurus* (*ecten* Gilbert), "distinguished by the excessively elongate body and depressed snout." Gilbert (1895) described *Bathyphasma* based on its simple, elongate, sharp teeth (unique at that time). Jordan and Evermann (1898:2866), in an appendix, changed the name of the subgenus *Allurus* (containing *Careproctus* (*Allurus*) *ecten*) to *Allinectis* because *Allurus* was preoccupied. They also included a description of a new genus (*Prognurus* Jordan and Evermann) and species (*P. cypselurus* Jordan and Gilbert), antedating the publication of what evidently was to be the original species description in *Fishes of the Be- ring Sea* (Jordan and Gilbert 1899). The species of *Prognurus* were distinguished by an elongate, forked tail. Burke (1912b) synonymized *Enantioliparis* with *Careproctus* because its supposedly distinguishing characters were common to many species of the latter genus. *Prognurus* was synonymized in the same year by Gilbert and Burke (1912b), who gave no reason for doing so. *Bathyphasma* was synonymized with *Careproctus* by Burke (1930:95) because other *Careproctus* species had been found with the same kind of teeth as *C. ovigerum*, thus removing the only character which separated the two genera.

At present there is some doubt about the validity of the characters being used to separate *Liparis* and *Careproctus*. Cohen (1960) has shown that a species of *Liparis* possesses only the anterior nostril, a character which is presently used to distinguish *Careproctus* from *Liparis*. Further investigation is necessary to show what, if any, characters separate the two genera.

KEY TO SPECIES OF *Careproctus*
FOUND IN THE STUDY AREA

- 1a. Disk length 3.1 or less in head length; dorsal fin rays 44–46; pyloric caeca about 16. (Mouth large, teeth recurved, very numerous and sharp) . *C. ovigerum* (p. 11)
- 1b. Disk length more than 3.1 in head; dorsal fin rays more than 46; pyloric caeca fewer than 13 or more than 20 2
- 2a. Upper pectoral ray extremely elongate, 0.5–0.7 in head length; pectoral fin deeply notched, rays 17–23. Dorsal fin rays 50–54, anal fin rays 44–48
 *C. longifilis* (p. 13)

- 2b. Upper pectoral ray not elongate, about equal to head length or shorter; combination of characters not as above 3
- 3a. Pyloric caeca more than 20, long and slender; stomach pale 4
- 3b. Pyloric caeca fewer than 15 5
- 4a. Disk wider than long, distinctly triangular; opercular spine dorsally curved, its tip almost horizontal, on a level with lower orbital margin *C. cypselurus* (p. 16)
- 4b. Disk longer than wide, definitely elliptic; opercular spine posteriorly curved, its tip well below ventral orbital margin *C. melanurus* (p. 14)
- 5a. Pectoral fin rays 29 or more; stomach black, disk more than 9.0–12.5 in head length *C. gilberti* (p. 17)
- 5b. Pectoral fin rays 27 or fewer; stomach pale, disk less than 7.3 in head length ... 6
- 6a. Inner teeth with lateral lobes; most of outer teeth stout, blunt, and simple. (Snout-anus in head length 0.9–1.0) *C. oregonensis* (p. 18)
- 6b. Teeth simple, sharp 7
- 7a. Lower pectoral fin lobe 1.2–1.4 in head length; upper pectoral fin ray slightly higher than or on level with posterior of maxillary; mouth small, tadpolelike, posterior margin of premaxillary tooth band nearly straight, no symphyseal gap evident (Fig. 8) ... *C. microstomus* (p. 20)
- 7b. Lower pectoral fin lobe 0.6–1.1 in head length; upper pectoral ray on a level with lower orbit; mouth not tadpolelike, teeth sharp, posterior margin of band evenly curved (Fig. 8) *C. filamentosus* (p. 23)

Careproctus ovigerum (Gilbert)

(Figure 6a)

Bathypasma ovigerum GILBERT, 1895:448 (original description of holotype, USNM 48622; *ovigerum* type-species of *Bathypasma*, by monotypy); JORDAN, EVERMANN, AND CLARK 1930:401 (distribution; synonymy).
Careproctus ovigerum: JORDAN AND EVERMANN, 1898:2128, fig. 767 (description; in key); BURKE 1930:131, fig. 52 (description; synonymy; in key); CLEMENS AND WILBY 1961: 348, fig. 231 (description of holotype; in key); GRINOLS 1965:149 (distribution, synonymy); QUAIST AND HALL 1972: 28 (distribution, references); HART 1973:575, fig. (description, distribution, references).

DIAGNOSIS—A *Careproctus* with disk length 32–38 percent of head length, pectoral fin of 34 rays, caudal fin of 11 rays. Very large mouth with large, stout, sharp, simple, recurved canines in medium bands narrowing laterally.

DESCRIPTION.

Counts: Dorsal fin rays 43–45, anal fin rays 34–37, pectoral fin rays 31–34, caudal fin rays 11. Pyloric caeca 16–19. Vertebrae 47–49. Cephalic pores 2–6–7–1.

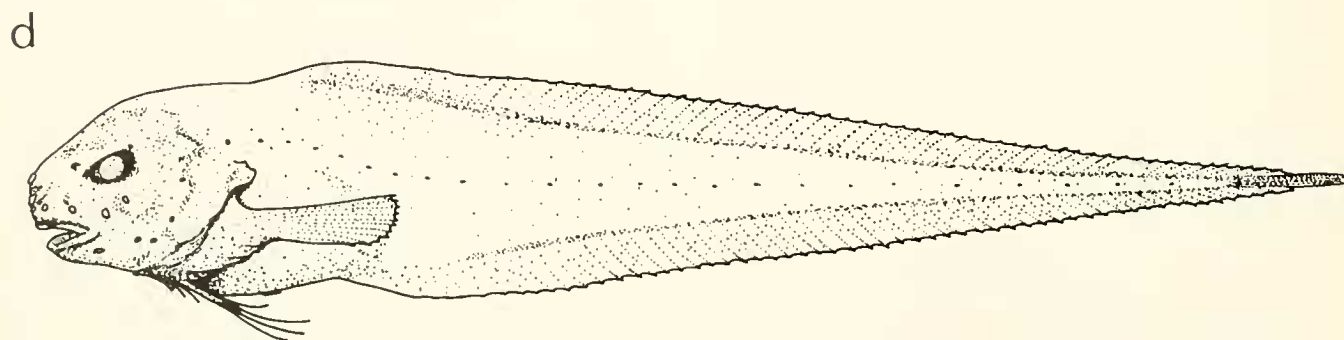
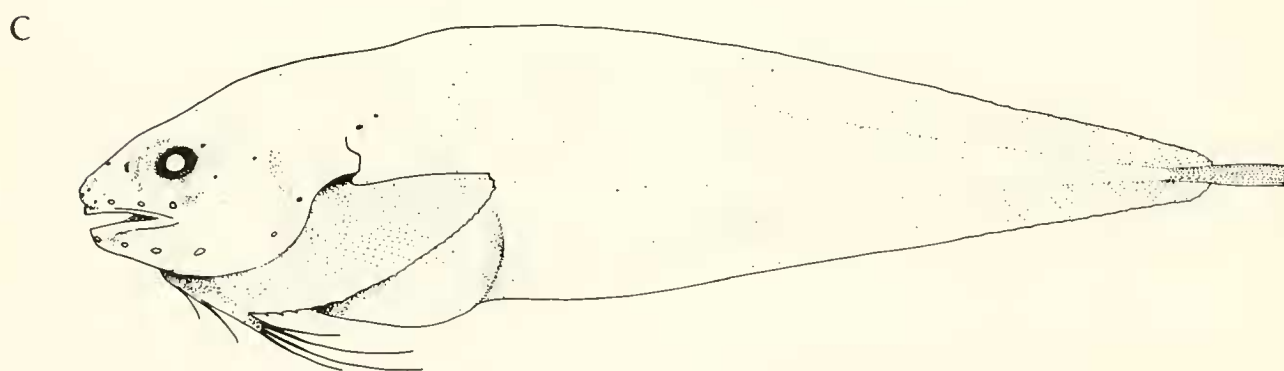
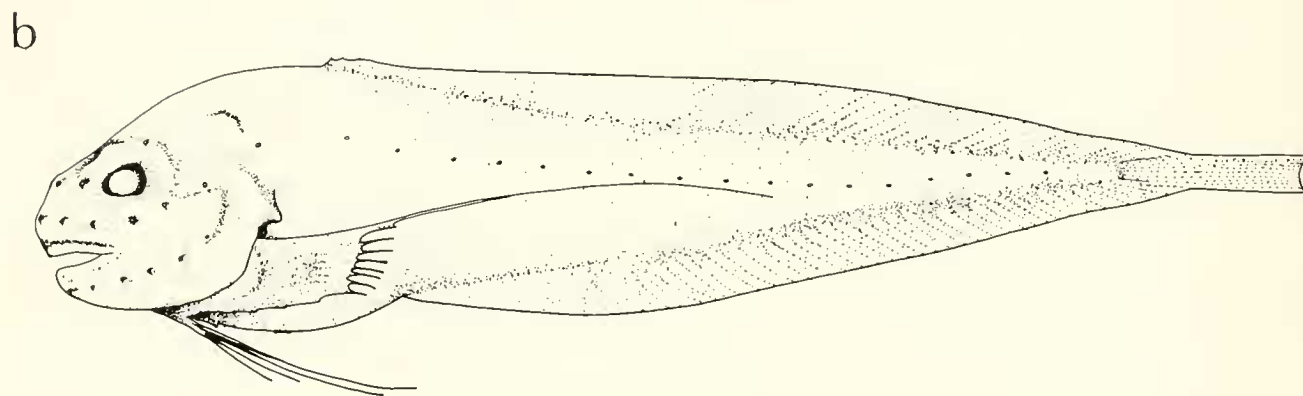
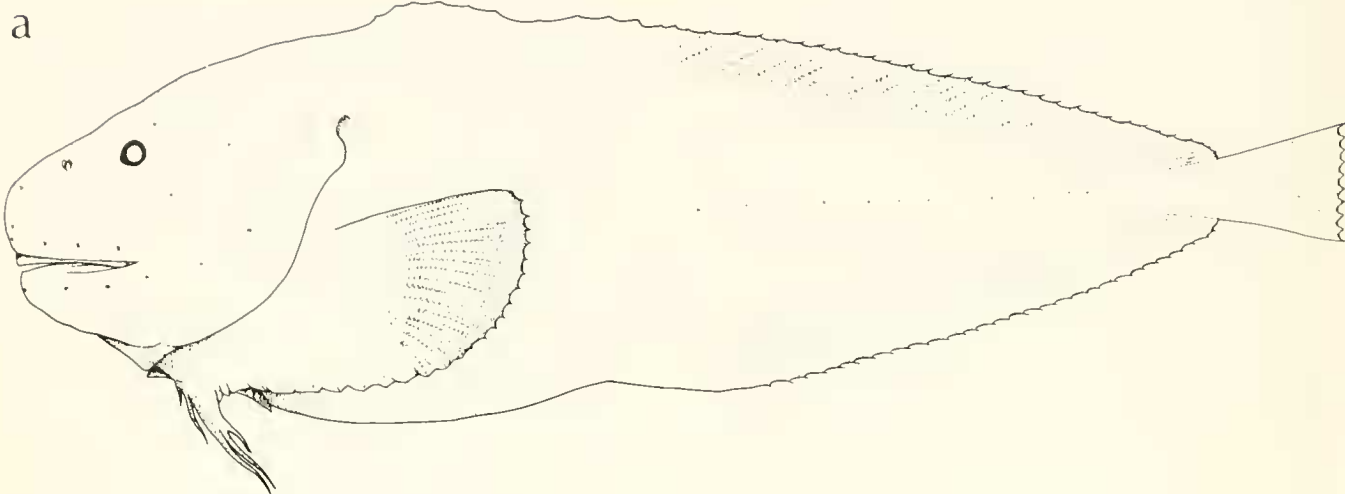
Morphometry: Head length 28.6–30.8% SL, body depth 27.0–34.8; eye length 10.3–17.0% head length; disk length 32.3–38.5, mandible to disk 12.0–14.1, disk to anus 40.0, lower pectoral fin-lobe length 50.0–55.6, upper pectoral fin-lobe length 55.6–62.5.

Head heavy, broad, lateral and dorsal aspects evenly rounded. Eyes relatively small. Nostrils prominent, single, tubular, moderately long, larger than cephalic pores. Mouth wide, maxillary extending to below rear of eye; cleft reaching below pupil. Teeth simple, small, slender, very sharp, slightly recurved canines in anteriorly broad band of oblique rows, narrowing rapidly posteriorly; outer teeth smaller. Gill openings above pectorals and extending ventrally over about four rays. Opercular flap long, heavy and weakly ossified. Cephalic pores relatively small, prominent; those on mandible somewhat larger than others. Wide interspace between pores nearest mandibular symphysis.

Pectoral fins large, broad based. Upper ray even with or above posterior corner of maxillary. Pectoral fin distinctly notched, upper rays gradually decreasing in length, their spacing increasing ventrally to lower lobe. Tips of all rays free. Lower lobe of four to six rays, the most ventral very short, almost buried in flesh, the others increasingly free up to half their length. Very wide gap (24 percent HL) between lower pectoral fin lobes at pectoral symphysis.

Disk extremely large, slightly cupped, almost round with very wide margin. Distance of anus from posterior margin of disk about equal to disk diameter. Small anal papilla present in males. Body very heavy, massive, tapering to the broad emarginate caudal fin which is about one-half confluent with dorsal and anal fins. Dorsal fin origin posterior to gill opening, most of length of anterior rays buried in gelatinous matrix, tips of first three to four rays free. Shallow notch beginning at about level of anus present in dorsal fin of largest specimen (CAS 32345, 431 mm SL). Anal fin origin far posterior to anus, somewhat posterior to vertical through end of notch in dorsal fin. Both anal and dorsal fins emarginate, broad, well developed.

Skin thin but relatively tough, with rudimen-



tary pores on lateral line and widely scattered over entire surface of body and fins, except the caudal fin; a suggestion of pore rows converging towards anal fin origin.

Stomach large, pyloric caeca long, slender, pale, located on right side of abdomen.

Body color pale pink, edges of all fins blackish. Gill cavity and mouth pale. Peritoneum blackish or mottled, stomach pale.

RELATIONSHIPS.—The affinities of *C. ovigerum* are unclear; it possesses primitive characters such as large pectoral and caudal fins, short dorsal and anal fins, a large disk, a dorsal fin notch, a posterior anus position, and pyloric caeca on the right side of the viscera. However, its teeth, because of which it was originally placed in a separate genus, show no trace of lobes such as are present in the teeth of *Liparis*, and it possesses a single nostril.

REMARKS.—*Careproctus ovigerum* is one of the largest liparids. Compared to others from the same depths, it is a giant. The function of the extremely large disk is unclear, as the species apparently lives on a soft mud bottom. The nature of the mouth, teeth, and fins implies a sedentary existence in which prey is awaited and secured by quick darts.

Gilbert (1895) concluded that this species was a mouth breeder because the holotype, a male, held developing eggs in its mouth when captured. However, a female (CAS 32345, 431 mm SL), with very large ovaries, contained nearly mature eggs of over 7 mm diameter. If all the mature eggs were spawned at the same time, there would be far too many for any single individual to hold in its mouth. Possibly more than one male breeds with each female, or breeding may be protracted; I consider it more likely that the holotype ate the eggs in the net during capture.

DISTRIBUTION.—*Careproctus ovigerum* is found off the coasts of Oregon, Washington, and British Columbia between 2510 and 2904 m.

MATERIAL EXAMINED. *Holotype*: USNM 48622, male, 318 mm TL, ALBATROSS sta. 3342, off Queen Charlotte Island, British Columbia, 52°39'30"N, 132°38'00"W, 1588 fm (2904m), 3:IX:1890, poor condition.

Other Material: CAS 32345, female, 431 mm SL, BMT DWD 8, sta. DWD 3, 48°07.8'N, 127°04.3'W, 2510 m, off Tatoosh,

Washington, 10:IX:1971; USNM 211572, male, 302 mm SL, OTB 132, sta. NH 65, 44°36.2'N, 125°35.0'W, 2853 m, 14:X:1966.

Careproctus longifilis Garman

(Figure 6b)

Careproctus longifilis GARMAN, 1892:9 (original description of holotype, MCZ 28703); GARMAN 1899:115, pls. 27–29 (description of holotype); JORDAN, EVERMANN, AND CLARK 1930:403 (distribution; synonymy); BURKE 1930:130, fig. 51 (description of holotype; synonymy; in key); RASS 1964:4, fig. 1 (discussion of morphology).

DIAGNOSIS.—A *Careproctus* differing from all others of the genus in its extremely elongate uppermost pectoral ray. Pectoral fin of 17–23 rays, deeply notched, dorsal fin rays 50–54. Color black, pores enlarged, lined in white and very distinct. Head rounded, almost globular in large specimens. Body covered with clumps of sharp, long, slender, deciduous prickles.

DESCRIPTION.

Counts: Dorsal fin rays 52 (50–54), anal fin rays 46 (44–48), pectoral fin rays 18 (17–23), caudal fin rays 9 (8–9). Pyloric caeca 11 (10–13). Vertebrae 57 (55–58). Cephalic pores 2–6–7–1.

Morphometry: Head length 23.8 (21.7–26.3) % SL, body depth 21.3 (17.2–23.8); disk length 18.9 (16.1–22.2) % head length, upper pectoral fin-lobe length 166.7 (142.8–200.0), lower pectoral fin-lobe length 90.9 (78.2–111.1), snout to anus 90.0 (78.2–111.1), mandible to anus 76.9 (66.7–83.3), mandible to disk 45.4 (34.5–58.8), disk to anus 15.9 (12.4–21.7).

Head large, relatively heavier in larger individuals; noticeably globular, especially in largest specimen examined (162 mm SL). Eyes not protruding, lying beneath transparent window in loose skin over pupil. Nostrils single, situated on horizontal through center of pupil, less than one diameter of eye anterior to orbit. Mouth horizontal, maxillary reaching to below pupil. Teeth sharp, slender canines, arranged in oblique rows forming narrow band, the band narrowing posteriorly but not becoming uniserial; outer teeth smaller. Opercular opening beginning well above upper pectoral fin ray, extending ventrally in front of upper two to seven rays. Opercular flap

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FIGURE 6. (a) *Careproctus ovigerum* (Gilbert). CAS 32345, female, 431 mm SL, from off Tatoosh, Washington. (b) *Careproctus longifilis* Garman. CAS 32344, female, 113 mm SL, from off Newport, Oregon. (c) *Careproctus gilberti* Burke. BCPM 72–9–1, female, 117 mm SL, from off British Columbia. (d) *Careproctus oregonensis* Stein, new species. Holotype, USNM 214596, male, 101 mm SL, from off Newport, Oregon. All drawings by Paul Iwanaga.

slightly lobed; spinous support weak, not obvious. Skin forming gill slit very loose, making accurate description difficult. Cephalic pores 2-6-7-1, large, prominent, lined in white.

Pectoral fin of two lobes widely separated by a deep notch, connected by a series of widely spaced, very short, webbed rays. Dorsalmost ray even with posterior corner of maxillary, or slightly above it. Upper pectoral fin lobe of 9 to 12 rays, upper ray greatly produced, reaching far posterior to origin of anal fin. Tips of all lower rays in upper lobe free, although none produced. Lower pectoral fin-lobe rays showing a gradually increasing exertion and lengthening dorsally. Anteriormost pectoral fin ray very short, with relatively little free length, the uppermost ray elongate, free for most of its length. Number of lower lobe rays varies from 4 to 6. Symphysis of pectorals located below posterior of maxillary.

Disk small, deeply cupped, margin narrow, located between verticals through opercular slit and posterior margin of orbit; its anterior margin is usually even with the latter.

Body becomes dorso-ventrally flattened posterior to opercles, and tapers rapidly to caudal fin. Caudal region slightly elongate. Caudal fin about one-fourth confluent with vertical fins. Skin thin, tough, very loosely attached to body. Prickles present, evenly distributed over entire body and head, including fins; arranged in radiating clumps of up to eleven spines, each of which is very slender and needlelike. Prickles very easily lost, leaving whitish pits on skin surface as only trace of their presence.

Pyloric caeca short, fat and pointed.

Body color black, with the exceptions noted above. Mouth, gill cavities, and peritoneum also black; stomach pale, often finely streaked with black, pyloric caeca pale.

RELATIONSHIPS.—*Careproctus longifilis* is not closely related to any other known species of the genus; no other *Careproctus* has a greatly elongated upper pectoral ray. It differs from *C. microstomus* and *C. filamentosus* in having stubbier teeth, a rounder head, opercular openings extending ventrally in front of pectoral fins, shorter dorsal and anal fins, prickles on the body, and an often black streaked stomach. *Careproctus oregonensis* differs from it in having lobed teeth, slightly more pectoral rays, longer dorsal and anal fins, and stomach always pale.

REMARKS.—The holotype of *C. longifilis* (MCZ 28703) is almost useless as a referent, hav-

ing completely fallen apart with the exception of one pectoral fin.

Although the Oregon specimens extend the range 4828 kms and show a few differences from the description of the type, there is no good reason why the Oregon specimens should not be considered as conspecific with *C. longifilis*. The primary difference lies in the original description of the gill slits of the type as being above the pectoral fins (Garman 1892). Burke (1930:130) says, "gill slit apparently above the pectoral fin" and also, "the type is mutilated beyond description." Considering the looseness of the skin and the above indicated variability in gill slit length, I conclude that these Oregon specimens represent *C. longifilis*.

DISTRIBUTION.—*Careproctus longifilis* has only been captured off Oregon between 1900 and 2997 m and off Panama in 3334 m. I expect that more specimens will be reported from deep water throughout the eastern Pacific Ocean.

MATERIAL EXAMINED. *Holotype*: MCZ 28703, ALBATROSS sta. 3374, Pacific Ocean off Panama, 2°35'00"N, 83°53'00"W, depth 1823 fm (3334 m) 3:III:1891, completely disintegrated except for one cleithrum and the rays on it.

Other Material: OSUO 1819, male, 117 mm SL, OTB 259, sta. THB-19, 45°55.5'N, 125°30.1'W, 1900 m, 17:VII:1968; USNM 214605, immature, 70 mm SL, BMT 265, sta. CP-2-C, 45°18.6'N, 126°31.5'W, 2750 m, 18:II:1971; CAS 33197, male, 122 mm SL, BMT 159, sta. CP-2-C, 45°16.5'N, 126°40.4'W, 2721 m, 18:I:1970; MCZ 50973, immature, 64 mm SL, BMT 336, sta. CP-3-D, 45°1.6'N, 127°31.0'W, 2850 m, 5:XI:1973; CAS 32344, female, 113 mm SL, BMT 335, sta. CP-3-D, 44°59.8'N, 127°29.2'W, 2884 m, 5:XI:1973; OSUO 2303, male, 68 mm SL, BMT 188, sta. CP-I-D, 44°58.6'N, 125°41.9'W, 2792 m, 17:III:1970; MCZ 50972, male, 116 mm SL, BMT 187, sta. CP-I-D, 44°55.4'N, 125°40.6'W, 2760 m, 17:III:1970; CAS 32343, female, 75 mm SL, BMT 187, sta. CP-I-D, 44°55.4'N, 125°40.6'W, 2760 m, 17:III:1970; OSUO 2018, male, 109 mm SL, BMT 69, sta. NAD 21, 44°43.9'N, 125°36.6'W, 2830 m, 28:III:1969; OSUO 2302, female, 162 mm SL, BMT 315, sta. CP-3-E, 44°44.9'N, 127°28.6'W, 2803 m, 2:II:1973; CAS 33198, female, 88 mm SL, BMT 293, sta. CP-I-XX, 43°42.0'N, 125°29.9'W, 2997 m, 17:VI:1972; OSUO 1821, female, 73 mm SL, OTB 112, sta. NH-65, 44°39.2'N, 125°35.3'W, 2810 m, 27:III:1966; OSUO 2032, female, 115 mm SL, BMT 70, sta. NH-65, 44°39.1'N, 125°30.3'W, 2830 m, 29:III:1969; USNM 214604, male, 126 mm SL, BMT 288, sta. CP-I-WW, 44°06.2'N, 125°22.7'W, 2946 m, 14:VI:1972.

Careproctus melanurus Gilbert

Careproctus melanurus GILBERT, 1892:560 (original description of holotype, USNM 44285, and other specimens); GILBERT 1895:469 (description; record); JORDAN AND EVERMANN 1898:2135 (description; distribution; in key); GILBERT 1915:354 (record); TOWNSEND AND NICHOLS 1925:15, pl. 3, fig. 1 (record); BURKE 1930:125, fig. 45 (description; distribution; in key); JORDAN, EVERMANN, AND CLARK 1930:403 (distribution; synonymy); BARNHART 1936:72, fig. 226 (de-

scription; distribution); SCHULTZ 1936:188 (distribution; in key); SCHULTZ AND DELACY 1936:135 (distribution; synonymy); BARRACLOUGH AND WALDICHUK 1954:502 (record); CLEMENS AND WILBY 1961:350, fig. 233 (description; distribution; in key); FORRESTER AND WILSON 1963:1095, fig. 1 (description; record); GRINOLS 1965:148 (distribution; synonymy); FITCH 1966:218 (record); DAY AND PEARCY 1968:2668, fig. 3 (record); FITCH AND LAVENBERG 1968:121, fig. 66 (description, distribution); BAILEY ET AL. 1970: 60 (listed); ALTON 1972:591, 611 (record); QUAST AND HALL 1972:28 (distribution, references); HART 1973:574, fig. . (description; distribution; in key); PEDEN AND CORBETT 1973:555–556, pl. 1, 2 (distribution; comments on reproduction); VOGT 1973:23 (description; possible record).

DIAGNOSIS.—A *Careproctus* with both trilobed and simple teeth; pectoral fin rays 27–33; disk oval, shorter than eye diameter, longer than wide; peritoneum black.

DESCRIPTION.

Counts: Dorsal fin rays 56 (53–57), anal fin rays 51 (47–51), pectoral fin rays 31 (27–33), caudal fin rays 10 (9–11). Pyloric caeca 26 (20–31). About 30 oblique rows of teeth on each half of upper jaw. Vertebrae 60 (57–63). Cephalic pores 2–6–7–2.

Morphometry: Head length 23.8 (20.4–26.3) % SL, body depth 23.3 (18.2–31.2); eye length 19.6 (15.9–23.8) % head length, disk length 14.9 (13.5–16.1), upper pectoral fin-lobe length 76.9 (55.6–100.0), mandible to anus 55.6 (40.0–66.7); disk length 76.9 (58.8–100.0) % eye length.

Head broadly rounded anteriorly, especially in larger specimens; smaller individuals with slightly flattened interorbital space. Snout blunt, protruding slightly or not at all. Occiput not swollen. Eyes large. Nostrils single, conspicuously tubular, usually above a horizontal line through pupil center, less than diameter of eye anterior to orbit. Maxillary extending posteriorly to below pupil. Teeth small, variable in shape, strongly lobed to simple with no suggestion of lobes. Lobed and unlobed teeth usually present in the same individual; when both types present, inner teeth lobed, outer teeth simple. Teeth in oblique rows forming narrow band in upper and lower jaws; narrow gap usually present at symphysis. Cephalic pores prominent in small individuals, relatively less prominent in large ones.

Postocular, supraocular, and suprabranchial pores much smaller than other pores on head. Symphyseal mandibular pores very close together, in some specimens separated by narrow septum. Opercular opening extending from high above pectoral fin to level of posterior of maxillary; opercular flap supported by spine angled sharply ventrad.

Pectoral fins distinctly lobed in small specimens, indistinctly so in large ones. Number of rays highly variable. Upper pectoral fin-ray level even with or slightly below posterior of maxillary. Upper lobe of 24–27 rays; space between rays in most specimens becoming gradually wider ventrally to lower lobe. Lower lobe of three to seven rays, always distinguishable by dissection, its rays more closely spaced than those more dorsally located. Length of lower lobe varies indirectly with size, much longer with freer rays in smaller specimens; relatively shorter and very fleshy in specimens longer than 220 mm SL, in which lower lobe becomes difficult to distinguish externally. Pectoral fin symphysis almost mental, anterior to a vertical through front of orbit and rear of maxillary.

Disk oval, perfect, cupped, width less than length. Margin wide, fleshy, slightly more so anteriorly.

Body very deep, dorso-ventrally flattened, with thick gelatinous subdermal layer which is especially prominent in larger individuals. Anus anterior to vertical through gill slit, males with a prominent, slender, long anal papilla. Dorsal fin origin posterior to vertical through gill slit, anterior dorsal rays deeply embedded in gelatinous tissue. Anal fin origin below about seventh dorsal ray. Dorsal and anal fins very high, especially so about two thirds of SL posteriorly. Posterior of body flattened dorso-ventrally, not attenuate. Caudal fin rays more than half overlapped by dorsal and anal fins. Skin thin, fragile, no rudimentary pores evident, but slight pits randomly distributed over surface.

Stomach large; pyloric caeca numerous; very long and thin, often folded back on each other.

Body color pink or reddish in life, with fins variably blackish; caudal region always dusky. Oral and branchial cavities black, peritoneum black, stomach and pyloric caeca pale.

RELATIONSHIPS.—*Careproctus melanurus* and *C. cypselurus* are very similar; their meristic and morphometric characters often overlap. Burke (1930:107) utilized the forked caudal fin of *C. cypselurus* as the means of distinguishing between them; however, this character is usually insufficient, as it is easily damaged on capture. More useful characters of *C. melanurus* are the oval disk, longer than wide vs. the triangular disk wider than long in *C. cypselurus*; the tip of the opercular spine angled ventrally and well below the orbit vs. the more horizontal opercular spine

above the lower margin of the orbit in *C. cypselurus*; the higher number of oblique maxillary tooth rows (30 vs. 25 in *C. cypselurus*); and the lower dorsal and anal fin-ray counts (D. 54–58 vs. 60–64, A. 37–50 vs. 53–56 in *C. cypselurus*).

DISTRIBUTION.—*Careproctus melanurus* has been reported from Alaska and British Columbia between 90 and 2286 m, off Oregon between 200 and 1600 m, off northern California at 960 m, and off southern California between 440 and 670 m. It is probably the liparid most commonly captured below 200 m; commercial fishermen capture it frequently.

MATERIAL EXAMINED. *Holotype*: USNM 44285, male, 177 mm SL, ALBATROSS sta. 2925, 32°32'30"N, 117°24'00"W, off southern California, 339 fm (620 m), 19:I:1889.

Paratype: USNM 126712, male, 133 mm SL ALBATROSS sta. 2892, 34°15'00"N, 120°36'00"W, 284 fm (519 m), 5:I:1889.

Other Material: NMC 68–1783, female, 120 mm SL; 50°45.5'N, 130°06.0'W, 1150–1200 fm (2103–2195 m), 11:IX:1964; OSUO 2070, male, 240 mm SL, OTB 423, sta. D1B 8, 47°38.6'N, 125°05.2'W, 200 m, 20:X:1971; OS 5093, female, 261 mm SL, off Astoria, about 46°15'N, longitude, depth and date of collection unknown; OSUO 1629, male, 151 mm SL, 46°05'N, 124°51'W, 73–658 m, 26:VI:1967; OS 5091, female, 221 mm SL, BMT 285, sta. NAD 8, 44°40.3'N, 124°35.1'W, 200 m, 7:III:1972; OSUO 747, female, 138 mm SL, OTB 120, sta. NAD 10, 44°34.0'N, 124°50.0'W, 640–650 m, 8:VI:1966; OSUO 2306, female, 282 mm SL, OTB 271, sta. NAD 15, 44°33.3'N, 125°12.6'W, 1600 m, 15:X:1968; OSUO uncatalogued, female, 312 mm SL, OT 52, sta. WH, 44°27.2'N, 125°13.3'W, 1370 m, 20:VI:1962; OSUO uncatalogued, female, 224 mm SL, OTB 620, sta. CBT 310 B, 43°27.6'N, 124°48.1'W, 530 m, 10:VI:1974; OS 5089, male, 175 mm SL, OTB 557, sta. CBT 310 J, 43°23.3'N, 124°51.9'W, 600 m, 28:X:1973; OSUO uncatalogued, female, 179 mm SL, BMT 349, sta. CBT 310 L, 43°21.8'N, 124°52.0'W, 700 m, 6:VI:1974; OSUO uncatalogued, female, 170 mm SL, OTB 559, sta. CBT 310 K, 43°22.1'N, 124°50.7'W, 600 m, 28:X:1973; OS 5073, male, 78 mm SL, OTB 567, sta. CBT 310 H, 43°20.1'N, 124°46.6'W, 535 m, 30:X:1973; OSUO 2305, male, 92 mm SL, CSUH OTB PR–1, off Cape Mendocino, 40°13'10"N, 124°57'00"W, 960 m, 26:I:1973.

Careproctus cypselurus (Jordan and Gilbert)

Prognurus cypselurus JORDAN AND GILBERT, in JORDAN AND EVERMANN, 1898: 2866 (original description of holotype, USNM 48232; distribution); JORDAN AND GILBERT 1899:478 (description; distribution); EVERMANN AND GOLDSBOROUGH 1907:33, pl. 20, fig. 2 (distribution); JORDAN, EVERMANN, AND CLARK 1930:403 (distribution; synonymy).

Careproctus cypselurus: GILBERT AND BURKE, 1912a:80, fig. 25 (description; distribution); BURKE 1930:127, fig. 47, 48 (description; distribution; synonymy; in key); SCHULTZ 1936:188 (distribution; in key); SCHULTZ AND DELACY 1936:136 (distribution; synonymy); SCHMIDT 1950:198 (distribution); WILIMOVSKY 1954:287 (distribution); MATSUBARA 1955:1193 (distribution; in key); WILIMOVSKY 1958:79

(distribution; in key); GRINOLS 1965:147 (distribution; unverified record; synonymy); QUAST AND HALL 1972:28 (distribution; references).

DIAGNOSIS.—A *Careproctus* with deeply forked caudal fin; disk less than 20% of head length, wider than long; shallowly notched pectoral fin of 34–36 rays; and lobed teeth.

DESCRIPTION.—The description by Burke (1930:127) is accurate with the following additions, which include his counts:

Counts: Dorsal fin rays 58–62, anal fin rays 53–56, pectoral fin rays 35 (34–36), caudal fin rays 10. Pyloric caeca 29–32. About 25 oblique rows of teeth on premaxillary. Vertebrae 65–67 (8 + 57–59). Cephalic pores 2–6–7–2.

Morphometry: Head length 21.7–24.4 % SL, body depth 20.0–23.8; eye length 16.7–20.0% head length, disk length 13.2–19.6, upper pectoral fin-lobe length 71.4–90.0, lower pectoral fin-lobe length 47.6–50.0; disk width 111.0% disk length.

Body stout anteriorly, head heavy. Snout blunt, broadly rounded laterally. Interorbital space broad, flat. Eyes round, black. Nostrils prominent, single, with long tubes. Maxillary reaching posteriorly to below rear of eye. Teeth stout, small, with prominent lobes on largest; arranged in about 25 oblique rows of up to 11 teeth, in band of medium width in both jaws. Opercular flap broadly rounded, supported by a broad, dorsally curved spine, the tip of which is about horizontal and on a level with lower portion of orbit. Gill slit wholly above pectoral fin, its ventralmost point separated from upper pectoral ray by a noticeable gap. Anterior cephalic pores larger and more prominent than supraocular and suprabranchial pores.

Upper pectoral fin ray on a level with posterior of maxillary. Pectoral fin base angled sharply antero-ventrally, symphysis below anterior of eye. Upper lobe of 28–29 rays, not distinct from rays in notch, upper lobe reaching slightly posterior to anal fin origin. Pectoral rays distinctly emarginate, tips free, lower lobe ray tips becoming shorter ventrally, their spacing slightly wider at most ventral point. Notch shallow, indistinct. Lower pectoral fin lobe of six to eight short rays which increase evenly in length dorsally to about fifth ray. Indistinct gap present at symphysis of pectorals.

Disk distinctly triangular, wider than long. Margin thin, edges curled in towards center. Posterior margin almost straight in SU 22320.

Body tapers rapidly posterior to gill slit to a point slightly less than head length anterior to hypural plate; somewhat attenuate posterior to that point. Posterior to pectoral fin tips trunk becomes dorso-ventrally flattened. Dorsal fin origin posterior to vertical through opercular flap, anterior rays weak, buried in tissue. Anal fin origin below about sixth dorsal ray. Both dorsal and anal rays long, adding greatly to apparent depth of body. Caudal fin very distinctly forked, about one-third confluent with vertical fins.

Stomach and pyloric caeca located left dorsally in body cavity. Caeca long (not folded back on one another), relatively stout, tips rounded.

Body color in alcohol pale; fins darker edged. According to Burke (1930:128), in life "greater part of head, body, and fins deep purplish indigo, the anterior part of the sides almost clear red, with little blue; head again becoming deeper blue, but with more red than the posterior part of trunk;" mouth and gill slit dusky, peritoneum blackish. Stomach and pyloric caeca pale.

RELATIONSHIPS.—See description of *C. melanurus*.

DISTRIBUTION.—*Careproctus cypselurus* has been collected in the Sea of Okhotsk, the Bering Sea, and off the coasts of Alaska and Washington. Grinols's (1965) article contains an unverified record off the Oregon coast; I feel *C. cypselurus* may occur as far south as northern California.

MATERIAL EXAMINED. *Holotype*: USNM 48232, male, 180 mm SL, ALBATROSS sta. 3634, western Bering Sea, 54°51'00"N, 167°27'00"W, 664 fm (1214 m), 7:VII:1896.

Other Material: USNM 74736, male, 233 mm SL, ALBATROSS sta. 5015, Okhotsk Sea, 46°44'00"N, 144°02'00"E, 510 fm (933 m); 26:IX:1906; SU 22320, female, 160 mm SL, ALBATROSS sta. 4797, Staritschkof Island, 52°37'30"N, 158°50'00"E, 682 fm (1248 m), 20:VI:1906.

Careproctus gilberti Burke

(Figure 6c)

Careproctus gilberti BURKE, 1912a:570 (original description of holotype, USNM 64110; distribution); BURKE 1930:138, fig. 61, 62 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930: 402 (distribution; synonymy); SCHULTZ 1936:188 (distribution; in key); WILIMOVSKY 1954:286 (distribution); WILIMOVSKY 1958:79 (distribution; in key); CLEMENS AND WILBY 1961:349, fig. 232 (description; distribution; in key); ISAKSON ET AL. 1971:668 (record); ALTON 1972:591, 610 (record); QUAIST AND HALL 1972:28 (distribution; references); HART 1973:573, fig. (description; distribution; in key).

Careproctus spectrum BEAN, 1890:40 (part); EVERMANN AND GOLDSBOROUGH 1907:333 (part; cited in Bean 1890).

Careproctus colletti EVERMANN AND GOLDSBOROUGH 1907:333 (record).

Paraliparis holomelas GILBERT, 1895:441 (part); EVERMANN AND GOLDSBOROUGH 1907:334 (part; only those specimens from ALBATROSS sta. 4292, 4293).

Careproctus gilberti JORDAN AND THOMPSON, 1914:282, pl. 34, fig. 1, 1a. (not of Burke 1912a; subsequently renamed *C. jordani* by Burke 1930:192).

DIAGNOSIS.—A *Careproctus* with reduced disk, 8.0–11.0% head length; pectoral fin of 30–33 rays; gill slit above pectoral fin, extending ventrally in front of about 14 upper pectoral fin rays; stomach black.

DESCRIPTION.—The description by Burke (1912a) is accurate with the following additions:

Counts: Dorsal fin rays 49–55; anal fin rays 44–48; pectoral fin rays 30–33; caudal fin rays 8–9. Pyloric caeca 10–12. Cephalic pores 2–6–7–2.

Morphometry: Head length 26.3–27.8% SL, body depth 25.0; eye length about 20% head length, disk 8.0–11.0, upper pectoral fin-lobe length 52.6–62.5, lower pectoral fin-lobe length 71.4–90.9.

Maxillary teeth slender, very sharp, much recurved, none with lateral lobes, in about 30 oblique curved rows of eight or fewer teeth each, forming a band of moderate width. Outermost teeth much smaller, size and prominence gradually increasing towards inside of jaw. Mandibular teeth similar to premaxillary teeth but forming a narrower band, innermost teeth abruptly larger than outer teeth. Narrow symphyseal gap present in both jaws.

Eye about five in head, lower half in BCPM 72–9 not silvery as described by Burke (1912a) and as in holotype, but black. Pupil small. Cephalic pores slightly enlarged, the postocular, supraocular and second suprabranchial pores smaller.

Upper pectoral fin-ray level between lowest margin of orbit and posterodorsal edge of maxillary. Upper pectoral fin lobe rounded, reaching second anal fin ray, rays ventral to fourth ray increasingly emarginate; rays of notch slightly more widely spaced than upper lobe rays, indistinct from them in large specimens; the holotype has 15 upper pectoral fin-lobe rays; upper lobes not distinct in BCPM 72–9. Lower pectoral fin-lobe rays six to seven, almost reaching anal origin, free for most of their length, which increases gradually dorsad. Symphysis of pectoral fins very prominent, below anterior of orbit rim.

Disk hidden between lower pectoral lobes, its shape subtriangular in specimens I examined,

apparently a result of being compressed by lower pectoral lobes in death.

Anus close to disk, the two separated by a distance equal to disk length. Anal papilla present in males, stout, not prominent.

Anterior dorsal fin rays hidden in thick skin. Caudal fin less than one-half confluent with vertical fins; tips of rays not coiled as reported by Burke (1912a).

Skin transparent, thick, relatively tough. Stomach large, pyloric caeca stout, tips rounded.

Body color in life probably pinkish; skin colorless, body with scattered melanophores, denser on dorsal and anal fin bases, none present on head. Oral and branchial cavities slightly darker than body, but not dusky or blackish; peritoneum pale or silvery, with evenly scattered melanophores. Stomach black, pyloric caeca pale.

RELATIONSHIPS.—*Careproctus gilberti* is most closely related to *C. ostentum* Gilbert, from which it differs in having a longer disk (8–11% of head length vs. 5%). I am not completely convinced that these two species are different; comparison of many more specimens is required. Burke (1930:139) felt that *C. spectrum* Bean could also be easily confused with *C. gilberti*, but *gilberti* is easily distinguished by its longer disk (25% of head length), shorter gill slit (located completely above pectoral fin) and its pale stomach.

REMARKS.—The literature for this species contains numerous references to misidentifications, some of which (see Burke 1930:138) cannot be verified or easily understood. I have included in the synonymy only those which I felt I could interpret properly.

DISTRIBUTION.—*Careproctus gilberti* has been recorded from the southeastern Bering Sea, Alaska, the Aleutian Islands, British Columbia off Prince Rupert, Hecate Strait, and Seymour Inlet, and Oregon off the Columbia River. The depth of occurrence is from 187 to 886 m and is shallower towards the northern part of the range. I expect the distribution of this species to extend to northern California.

MATERIAL EXAMINED. *Holotype*: USNM 64110, male, 74 mm SL, ALBATROSS sta. 4292, Cape Uyak, Alaska, S41°W, 7.2 miles (13.3 km), 94–102 fm (172–186 m), 15:VII:1903.

Paratypes: USNM 64111, female, about 42 mm SL, ALBATROSS sta. 4293, Shelikof Strait, S 10°, W 9.3 km off Cape Uyak, Alaska, 106–112 fm (194–205 m), 5:VIII:1903; USNM 64112, three males, 72, 70, 67 mm SL, one female, 74 mm SL, ALBATROSS sta. 2848, 55°10'00"N, 160°18'00"W, SE Alaska, 110 fm (201 m), 31:VII:1888.

Other Material: BCPM 72–9, two females, 117, 113 mm SL, 48°24.0'N, 126°10.7'W, off British Columbia, 254–258 fm (468–472 m), 9:II:1972.

Comparative Material: *Careproctus ostentum* Gilbert: syn-type, USNM 48619, male?, broken, ALBATROSS sta. 3324, 53°33'50"N, 167°46'50"W, 109 fm (199 m), 20:VIII:1890; syn-type, USNM 125590, male, about 55 mm SL, ALBATROSS sta. 3331, off Unalaska, 54°01'40"N, 166°48'50"W, 350 fm (640 m), 21:VIII:1890; paratype, SU 3023, sex unknown, 70 mm SL, ALBATROSS sta. 3324, 53°33'50"N, 167°46'50"W, 109 fm (199 m), 20:VIII:1890.

Careproctus spectrum Bean: syntypes, SU 48, 4 specimens, 68–92 mm SL, ALBATROSS sta. 2848, 55°10'00"N, 160°18'00"W, between Unga and Nagai Islands, 110 fm (201 m), 31:VII:1888.

Careproctus oregonensis, new species

(Figures 6d, 7)

DIAGNOSIS.—A *Careproctus* with parallel-sided teeth, inner teeth distinctly lobed in individuals less than 120 mm SL, weakly lobed or blunt in larger specimens; outer teeth blunt, simple canines at all sizes. Dorsal and anal fins of 63 (61–66) and 56 (55–57) rays, respectively; pectoral fin deeply notched, of 21 (19–23) rays, the upper ray even with lower margin of orbit. Suprabranchial pore single.

DESCRIPTION.

Counts: Dorsal fin rays 62 (61–67), anal fin rays 56 (55–57), pectoral fin rays 21 (19–23), caudal fin rays 8 (7–8). Pyloric caeca 10 (8–11). Vertebrae 67 (65–69). Cephalic pores 2–6–7–1.

Morphometry: Head length 19.6 (18.9–20.0) % SL, body depth 15.9 (12.8–21.3); disk length 19.2 (16.4–22.7) % head length, maxillary length 40.0 (37.0–41.7), upper pectoral fin-lobe length 76.9 (66.7–100.0), lower pectoral fin-lobe length 83.3 (76.9–100.0), snout to anus 100.0 (95.0–111.0), mandible to anus 90.9 (83.3–100.0), mandible to disk 38.5 (31.2–45.4), disk to anus 25.6 (19.6–33.3).

Head small, snout blunt, broadly rounded laterally; occiput swollen, somewhat more so in larger specimens. Body deepest at occiput. Nostrils single, small, with slightly raised rim, on a horizontal through pupil, one-half eye diameter anterior to orbit. Maxillary extending posteriorly to below pupil. Character of teeth variable, depending upon position in jaw and with size of individual. Inner teeth in small individuals always with strong vertically oriented lateral lobes which are never as large as central lobe (Fig. 7); some widely scattered teeth with strong lateral lobes. Outer teeth tend to be simple, blunt canines; outermost always simple. Largest individuals with

fewer and more weakly lobed teeth. All lobed teeth with parallel sides at least to shoulders; if no lateral lobes present, sides parallel almost to tip of tooth. Teeth in eight to ten oblique rows of up to ten teeth each, forming moderately wide bands on both premaxillary and mandible.

Gill slit wholly above pectoral fin, larger than longitudinal diameter of eye. Opercular flap bluntly triangular, supported by bifid spine.

Cephalic pores prominent, lined with white; anterior pores larger than posterior; supraorbital and suprabranchial pores smallest. Pores at mandibular symphysis much closer together and smaller than pores immediately posterior.

Pectoral fins deeply notched, upper-ray level even with or slightly below lower margin of orbit. Upper pectoral lobe of 11 (10–13) rays, none elongate; lobe reaching to or past anal fin origin. Rays of notch 3 (3–4), free for about one half of length, noticeably more widely spaced than those in lobes. Lower pectoral lobe with 6 (5–7) rays, reaching past anus but not to anal origin. Upper lobe usually shorter than lower lobe, but occasionally both equal.

Disk cupped, margin wide, perfect; located below or slightly anterior to vertical through gill slit.

Body tapers gradually to caudal fin, becoming slightly attenuate posteriorly. Anus about mid-way between disk and anal fin origin, slightly closer to anal fin in smaller individuals. Caudal fin about one-third confluent with dorsal and anal fins. Skin thin, loosely attached to body. Rudimentary pores present along lateral line; also present anteriorly, scattered near lateral line, gill slit, and on occipital region.

Stomach and pyloric caeca located left ventrally in body cavity; caeca short, triangular, tapering rapidly to point.

Color black or tan; mouth and branchial cavity black or dusky; peritoneum black; stomach and pyloric caeca pale.

ETYMOLOGY.—The name refers to the state of Oregon, off the shore of which this species was first collected, and *-ensis*, Latin for “of.”

RELATIONSHIPS.—*Careproctus oregonensis* is most similar to *C. bathycoetus* Gilbert and Burke, a species known only from the Sea of Okhotsk. The new species differs in having parallel-sided, blunt, lobed or simple canines instead of distinctly recurved, sharp teeth as in *C. bathycoetus* (Fig. 7), the upper pectoral fin ray on a level with the lower margin of the orbit, not

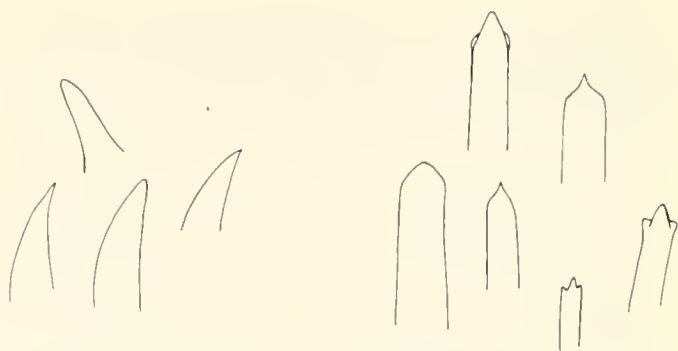


FIGURE 7. Teeth of *Careproctus bathycoetus* Gilbert and Burke (left) and *Careproctus oregonensis*, new species.

even with the posterior of the maxillary as in *C. bathycoetus*, and one, not two, suprabranchial pores. The problem of distinguishing between the two species is especially difficult because only the holotype of *C. bathycoetus* is known. The above and other differences, which may prove to be insignificant when more specimens become available, are summarized in Table 2. Maximum size may also be different; the standard length of the holotype of *C. bathycoetus* is 160 mm; the longest specimen collected of *C. oregonensis* is 153 mm SL, and the majority of specimens are less than 110 mm SL. I believe these are different species because of the above differences and the distance between the areas of collection. Additional specimens of *C. bathycoetus* should support this conclusion.

REMARKS.—Specimen OSUO 2043 differs from the others in several respects. Radiographs show a healed injury to the tail at about one-fourth SL anterior to the caudal fin; this evidently resulted in a distinctly more attenuate tail. The teeth are much blunter although present in the same number and pattern; the difference may be a result of a change in eating habits or injury on capture, as some teeth have been obviously broken.

DISTRIBUTION.—*Careproctus oregonensis* is presently recorded only from Cascadia Abyssal Plain off Oregon, between 1900 and 2818 m; the one relatively shallow record probably reflects the upper limit of vertical distribution. Future specimens should be taken off northern California, Washington, and at least southern British Columbia.

MATERIAL EXAMINED. *Holotype*: USNM 214596, male, 101 mm SL, OTB 50, sta. NH-65, 44°28.2'N, 125°32.8'W, 2800 m, 13:I:1965.

Paratypes: OS 5087, female, 102 mm SL, BMT 323, sta. CP-3-A, 45°56.4'N, 127°39.1'W, 2763 m, 13:III:1973; OSUO 2043, female, 153 mm SL, OTB 259, sta. THB-19, 45°55.5'N,

TABLE 2. MERISTIC AND MORPHOMETRIC CHARACTERS OF *Careproctus oregonensis* NEW SPECIES AND *Careproctus bathycoetus* GILBERT AND BURKE.

| Characters | Species | |
|--------------------------------|--|-------------------------------------|
| | <i>C. oregonensis</i> (type-series) | <i>C. bathycoetus</i> (holotype) |
| COUNTS | | |
| Dorsal fin rays | 62 (61-67) | 61 |
| Anal fin rays | 56 (55-57) | 55 |
| Pectoral fin rays | 21 (19-23) | 22 |
| upper lobe | 11 (10-13) | 10 |
| notch | 3 (3-4) | 5 |
| lower lobe | 6 (5-7) | 7 |
| Caudal fin rays | 8 (7-8) | 7 |
| Pyloric caeca | 10 (8-11) | 9 |
| Vertebrae | 67 (65-69) | 67 |
| MORPHOMETRY | | |
| Percent of standard length | | |
| Head length | 19.6 (18.9-20.0) | 20.6 |
| Body depth | 15.9 (12.8-21.3) | 18.2 |
| Percent of head length | | |
| Disk length | 19.2 (16.4-22.7) | 15.5 |
| Maxillary length | 40.0 (37.0-41.7) | 40.1 |
| Upper pectoral fin-lobe length | 76.9 (66.7-100.0) | 82.4 |
| Lower pectoral fin-lobe length | 83.3 (76.9-100.0) | 77.2 |
| Snout to anus length | 100.0 (95.0-111.0) | 101.5 |
| Mandible to anus length | 90.9 (83.3-100.0) | 81.8 |
| Mandible to disk length | 38.5 (31.2-45.4) | 39.2 |
| Disk to anus length | 25.6 (19.6-33.3) | 23.4 |
| Eye length | 20.2 (15.3-24.6) | 17.0 |

125°30.1'W, 1900 m, 17:VII:1968; OSUO 2298, female, 119 mm SL, BMT 277, sta. CP-3-A, 45°54.9'N, 127°33.2'W, 2765 m, 17:V:1971; OSUO 2066, female, 89 mm SL, BMT 280, sta. CP-3-C, 45°21.5'N, 127°33.0'W, 2800 m, 18:V:1971; OSUO 2297, female, 133 mm SL, BMT 265, sta. CP-2-C, 45°18.7'N, 126°34.4'W, 2750 m, 18:II:1971; OSUO 2296, male, 62 mm SL, BMT 266, sta. CP-2-C, 45°17.5'N, 126°28.4'W, 2710 m, 18:II:1971; USNM 214599, female, 54 mm SL, BMT 191, sta. CP-1-C, 45°17.4'N, 125°49.2'W, 2605 m, 18:III:1970; CAS 33191, female, 96 mm SL, BMT 268, sta. CP-2-D, 44°58.8'N, 126°37.5'W, 2770 m, 19:II:1971; USNM 214598, male, 108 mm SL, BMT 269, sta. CP-2-D, 44°57.7'N, 126°40.0'W, 2721 m, 19:II:1971; CAS 33194, immature, 50 mm SL, BMT 95, sta. CP-1-D, 44°56.1'N, 125°35.3'W, 2706 m, 16:VII:1969; OS 5082, male, 80 mm SL, BMT 187, sta. CP-1-D, 44°55.4'N, 125°40.6'W, 2760 m, 17:III:1970; USNM 214600, male?, 63 mm SL, BMT 161, sta. CP-2-D, 44°53.5'N, 126°30.7'W, 2770 m, 19:I:1970; CAS 33193, female, 119 mm SL, BMT 317, sta. CP-3-E, 44°44.6'N, 127°28.9'W, 2818 m, 3:II:1973; CAS 33192, female, 142 mm SL, BMT 163, sta. CP-2-E, 44°43.6'N, 126°30.8'W, 2787 m, 19:I:1970; USNM 214597, female, 106 mm SL, BMT 119, sta. CP-1-E, 44°42.5'N, 125°35.6'W, 2779 m, 5:X:1969.

Comparative Material: *C. bathycoetus* Gilbert and Burke: holotype, USNM 73337, female, 160 mm SL, ALBATROSS Sta. 5030, southern Sea of Okhotsk, 46°29'30"N, 145°46'00"E, 1800 fm (3292 m), 29:IX:1906.

Careproctus microstomus, new species
(Figure 8)

DIAGNOSIS.—A *Careproctus* with long, slender, simple, sharp, canine teeth in a narrow, shallowly curved band of about eight oblique rows of five teeth each or fewer, a wide gap present between outer teeth and dentary edge; no symphyseal gap present in either jaw; oral cleft small, tadpolelike; lower pectoral fin lobe longer than upper, 69.2–84.7% head length, lower lobe rays free for less than half of their length.

DESCRIPTION.

Counts: Dorsal fin rays 63 (61–67), anal fin rays 56 (54–60), pectoral fin rays 24 (22–27), caudal fin rays 8. Pyloric caeca 5 (5–7). Vertebrae 68 (67–69?). Cephalic pores 2–6–7–1.

Morphometry: Head length 17.9 (17.0–20.0) % SL, body depth 19.1 (14.5–21.7); eye length 23.2 (17.4–27.4) % head length, disk length 21.4 (17.7–24.3), upper pectoral fin-lobe length 67.4 (64.8–79.1), lower pectoral fin-lobe length 77.8

(69.2–84.7); lower pectoral fin-lobe length 111.0 (100.0–125.0) % upper pectoral fin-lobe length.

Lateral profile of head rounded; snout blunt, slightly protruding. Head longer than wide, distinctly swollen laterally, depth at occiput less than maximum body depth. Eyes large, black, pupils exceptionally large. Nostrils single, tubular, medium long; distance anterior to orbit less than one half eye diameter. Mouth opening small, tadpolelike, lateral cleft reaching or almost reaching vertical through anterior margin of orbit, although maxillary reaches anterior edge or middle of pupil. Mouth relatively smallest in largest specimen, OSUO 2300, cleft not nearly reaching a vertical through anterior of orbital margin. Posterior of maxillary bone deeply covered by tissue, not easily discernible. Teeth very slender, sharp, slightly recurved canines, well separated, arranged in eight to ten oblique rows of up to five teeth each, forming narrow band following extremely shallow curve anteriorly, but with posterior margin almost straight, extending slightly behind oral cleft (Fig. 8). Outer teeth set well back from edge of mandible, lips widely separated from anteriormost teeth. No gap in teeth discernible at symphysis of either jaw. Cephalic pores enlarged, of even size anteriorly, postocular and supraocular pores smaller. Gill slit short, wholly above pectoral fin; opercular flap bluntly triangular, supported by bifid spine of which upper arm is much stouter than lower; lower spine tip below horizontal drawn through midpoint of flap.

Pectoral fin deeply notched, upper ray even with or slightly above level of posterior of maxillary. Upper pectoral fin lobe of 12–14 rays, just reaching anal fin origin in specimens less than 150 mm SL; not as long in larger specimens. Rays of notch five to six, not always distinguishable from upper pectoral lobe rays, which are spaced slightly more closely than the former. Lower pectoral fin lobe of 6 (5–7) rays, always longer than upper lobe, usually markedly so; rays extend past anus but not nearly to anal fin origin.

Disk perfect, deeply cupped, margin moderately wide. Disk located between verticals through posterior of orbit and gill slit.

Body deepest at about anus; abdomen swollen in all specimens, apparently not due to presence of eggs in females, as males appear the same. Anus distant from disk, but always nearer to it than to anal origin. Tail slightly attenuate, tapering evenly to caudal fin. Dorsal fin origin behind

gill slit; anterior dorsal and anal fin rays short, buried in gelatinous tissue; rays at midlength of fins very long; high fins give appearance of much deeper body than is present. Caudal fin about one-fourth confluent with dorsal and anal fins.

Skin thin; rudimentary pores present, unevenly distributed along lateral line.

Stomach and pyloric caeca located left ventrally in body cavity; caeca short and fat.

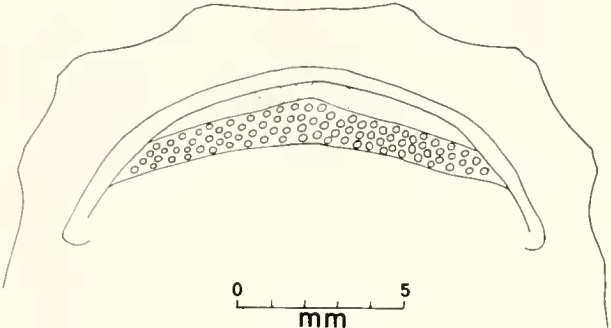
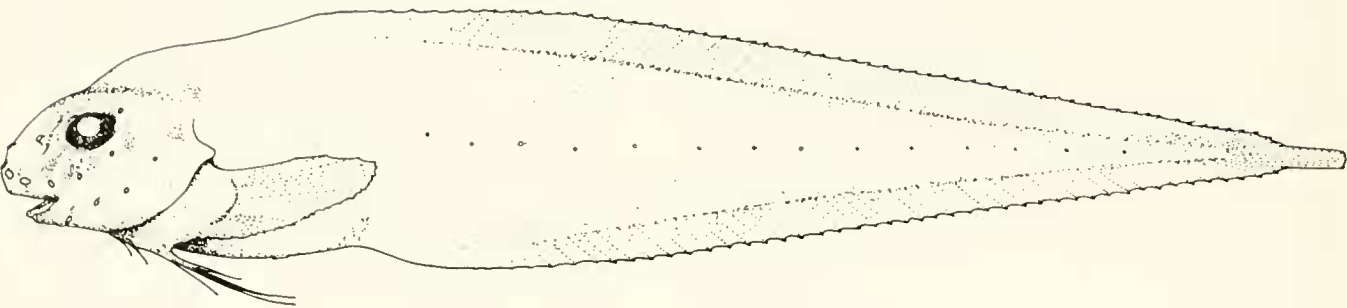
Skin color a dense, sooty black; cephalic pores lined in white; mouth, branchial cavity and peritoneum also black. Stomach with fine black reticulations or pale, not solid black; pyloric caeca pale. Teeth brown except for colorless tips.

ETYMOLOGY.—From the Greek *μικρός* (*micrus*), small, and *στόμαξ* (*stoma*), mouth.

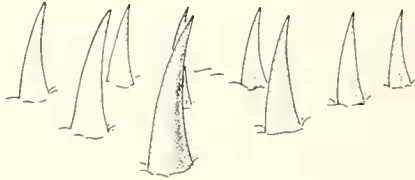
RELATIONSHIPS.—Although the long slender teeth of *C. microstomus* would ordinarily place it with the group including *C. colletti* Gilbert and *C. roseofuscus* Gilbert and Burke, its pattern of dentition is different. Furthermore, the short gill slit, long vertical fins, and comparatively reduced pectoral fins indicate its lack of affinity with them. *Careproctus microstomus* is similar to *C. filamentosus*, although distinguished from it by dentition, the smaller mouth and the shorter lower pectoral lobe.

REMARKS.—In most respects a typical abyssal liparid, *C. microstomus* differs distinctly from the typical in three characters: tooth color, dentitional pattern, and stomach color. The teeth are brown, with the exception of the colorless tips, in all the specimens I examined. Teeth in other abyssal species are colorless. All other liparids I examined have had teeth extending to the anterior vertical edge of the dentary; the anterior teeth in *C. microstomus* are set back from this edge a distance about equal to the width of the tooth band. The predental space is usually covered with a mucous layer and presents a smooth surface. Removal of this mucous layer reveals a series of pits in the skin which covers the bone. The pits look as though they are caused by loss of teeth; however, careful examination revealed no evidence of the previous presence of teeth. I believe that this predental space is a naturally occurring character involved in some way with feeding habits.

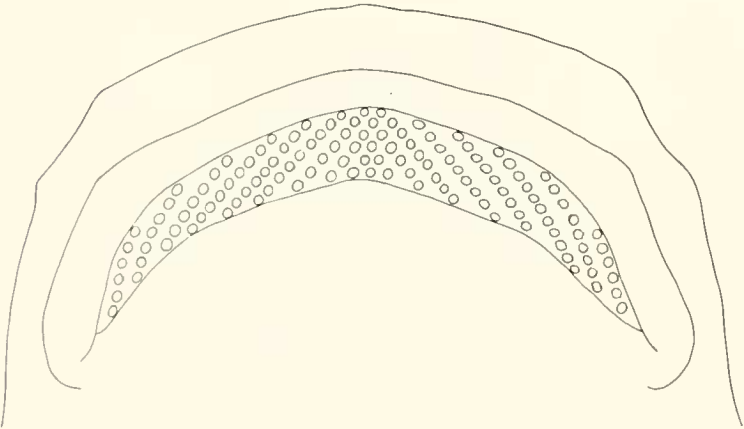
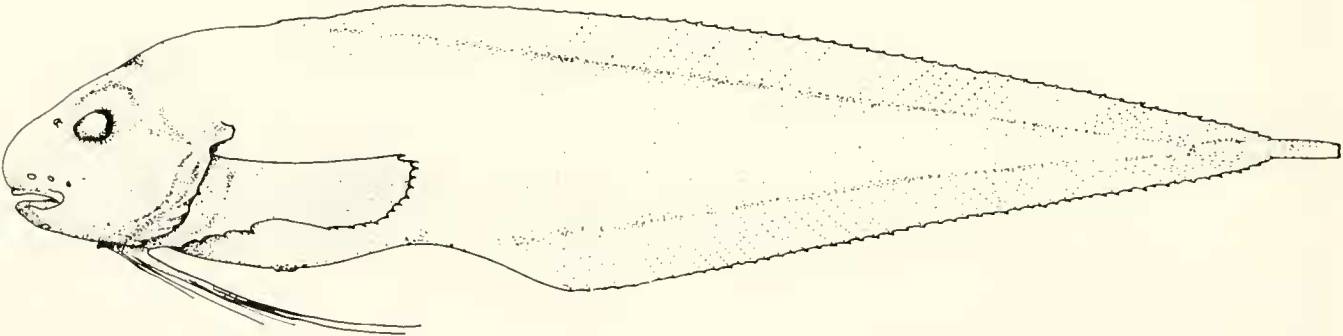
Most species of *Careproctus* have stomach color the same throughout the species; *C. microstomus* appears variable in this respect but is not. All *C. microstomus* have pale stomachs, although the stomachs of the holotype and CAS



0 mm 5



0 mm 0.5



0 mm 1.0

33195 are covered with a fine membrane reticulated in black with some scattered melanophores. All other specimens I examined lacked any trace of color on the stomach membrane. This may be a result of preservation.

DISTRIBUTION.—*Careproctus microstomus* is known only from off Oregon between 2721 and 3585 m. The deepest record is from Tufts Abyssal Plain (Station TP-6), about 560 km offshore. This area is separated from Cascadia Abyssal Plain, where the other specimens were captured, by the East Pacific Rise, which may form a barrier to offshore distribution of many species commonly found inshore. I believe the occurrence of *C. microstomus* to the west of the rise indicates a probable wide horizontal distribution.

MATERIAL EXAMINED. *Holotype*: USNM 214601, female, 146 mm SL, BMT 280, sta. CP-3-C, 45°21.5'N, 127°33.3'W, 2800 m, 18:V:1971.

Paratypes: USNM 214603, female, 183 mm SL, BMT 322, sta. CP-3-A, 46°03.5'N, 127°31.7'W, 2743 m, 12:III:1973; USNM 214602, female, 178 mm SL, BMT 269, sta. CP-2-D, 45°57.6'N, 126°40.0'W, 2721 m, 19:II:1971; OSUO 2299, male, 140 mm SL, BMT 278, sta. CP-3-C, 45°24.1'N, 127°39.0'W, 2811 m, 18:V:1971; CAS 33196, male, 153 mm SL, BMT 269, sta. CP-2-D, 44°57.7'N, 126°40.0'W, 2721 m, 19:II:1971; OSUO 2300, female, 197 mm SL, BMT 298, sta. TP-6, 44°59.7'N, 132°12.0'W, 3585 m, 5:X:1972; CAS 33195, female, 168 mm SL, BMT 318, sta. CP-3-C, 45°28.2'N, 127°28.7'W, 2783 m, 3:II:1973.

Careproctus filamentosus, new species

(Figure 8)

DIAGNOSIS.—A *Careproctus* with 21–24 pectoral rays, the lower pectoral fin lobe of five to seven rays which are free almost to their bases. Lower lobe rays increasing in length dorsally, the fourth and fifth longest, reaching at least to the anal fin origin. Teeth slender, sharp, arranged in a shallow crescent; dentary with teeth to edge.

DESCRIPTION.

Counts: Dorsal fin rays 61 (58–63), anal fin rays 55 (52–55), pectoral fin rays 24 (21–24), of which 12–14 are in upper lobe and 5–7 in lower; caudal fin rays 8 (7–8). Pyloric caeca 9 (6–9). Vertebrae 63–68. Cephalic pores 2–6–7–1.

Morphometry: Head length 17.6 (16.2–19.8) %

SL, body depth 14.8 (12.5–19.3), upper pectoral fin-lobe length 14.8 (12.6–16.7), lower pectoral fin-lobe length 19.1 (15.1–30.1); eye length 21.6 (19.1–24.8) % head length, disk 27.3 (21.7–35.8), mandible to anus 111.3 (99.0–123.5), mandible to disk 43.2 (34.6–51.8), disk to anus 38.8 (31.8–48.6); lower pectoral fin-lobe length 130.1 (93.5–188.0) % upper pectoral fin-lobe length.

Head small, snout broad, not as broad in smaller individuals, mouth slightly inferior. Occiput somewhat swollen, but not rising abruptly posterior to interorbital space; depth of head at occiput less than body depth. Nostrils single, tubular, of medium length, located on horizontal through pupil. Maxillary extending posteriorly to below eye. Teeth slender, simple, sharp, recurved, in about nine oblique rows of up to ten teeth, forming shallowly curved, crescent-shaped bands of moderate width in each jaw (Fig. 8). Teeth in individuals less than 90 mm SL thorn-shaped, abruptly broader at base; in larger specimens teeth gradually taper to tip. Teeth extend to edge of dentary. In holotype, a wide pitted area anterior to teeth, but covered by lips. Maxillary relatively longer in larger individuals. Cephalic pores not enlarged in holotype, somewhat more prominent in smaller individuals.

Gill slit wholly above pectoral, moderately long. Opercular flap supported by a strong bifid spine of which lower lobe very weak even in largest specimen examined. Upper pectoral fin lobe on a horizontal through midpoint of gill slit.

Pectoral fin deeply notched, but not to base; uppermost ray on horizontal with lower margin of orbit. No rudimentary rays present. Upper pectoral fin-lobe rays apparently emarginate, tips of all rays free. Rays of notch 4 (3–5), generally more widely spaced than in either lobe but not always clearly distinguishable from upper lobe rays. Lower pectoral fin-lobe rays increasing in length dorsally. Fourth and fifth rays of lower pectoral lobe longest, reaching at least to anal origin. All lower pectoral lobe rays except ventralmost ray more than one-half free; lower lobe rays of holotype almost completely free.

←

FIGURE 8. (top) *Careproctus microstomus* Stein, new species. Holotype, USNM 214601, female (partially skinned), 146 mm SL, from off Newport, Oregon. Ventral view of upper jaw (top left) and lateral view of premaxillary teeth (top right) of holotype showing characteristic shape of premaxillary teeth and their arrangement on jaw. (bottom) *Careproctus filamentosus* Stein, new species. Holotype, USNM 214592, female (partially skinned), 180 mm SL, from off Newport, Oregon. Ventral view of upper jaw (bottom left) and lateral view of premaxillary teeth (bottom right) of holotype showing characteristic shape of premaxillary teeth and their arrangement on jaw. Drawn by Paul Iwanaga.

Disk small, cupped in varying degrees; relatively larger and more deeply cupped in smaller individuals. Anterior and posterior margins of disk wider. Posterior edge of disk anterior to a vertical through gill slit.

Body tapers evenly to caudal fin, much more slender in smaller individuals, dorso-ventrally flattened posterior to abdomen. Dorsal origin posterior to gill slit, about over anus, anterior rays buried in gelatinous tissue. Anal origin below about tenth ray of dorsal. Caudal fin about one-half confluent with dorsal and anal fins.

Skin thin, loosely attached to body. Rudimentary pores unknown but probably present, skin of all specimens in poor condition.

Stomach located left ventrally in body cavity; pyloric caeca short, fat, and bluntly pointed.

Skin color black to tan in alcohol; mouth and branchial cavity dusky; peritoneum black; stomach and pyloric caeca pale.

ETYMOLOGY.—From the Latin *filamentum*, a fine untwisted thread, referring to the fine, elongate, lower pectoral rays.

RELATIONSHIPS.—*Careproctus filamentosus* appears to be most closely related to *C. colletti*; it has similar teeth, general morphometry, pore patterns, and elongate lower pectoral lobe rays. However, *C. filamentosus* differs most obviously in having narrower bands of teeth, a much shallower body in large specimens, fewer pectoral rays (21–24 vs. 28 in *C. colletti*), and an oval, not triangular disk.

Careproctus filamentosus differs from *C. microstomus* in the shape of the tooth patches in both jaws, its longer lower pectoral lobe, different cephalic pore arrangement, and larger mouth cleft.

DISTRIBUTION.—*Careproctus filamentosus* occurs off the Oregon coast between 2265 and 2940 m; its distribution evidently does not extend westward of the East Pacific Rise. It will probably be found off Washington and northern California.

MATERIAL EXAMINED. *Holotype*: USNM 214592, female, 180 mm SL, trawl BMT 270, sta. CP-2-E, 44°38.4'N, 126°42.0'W, 2850 m, 20:II:1971.

Paratypes: OSUO 2293, CAS 33189, two males, 50, 67 mm SL, BMT 195, sta. CP-1-A, 45°57.5'N, 125°46.2'W, 2265 m, 20:III:1970; USNM 214594, male, 65 mm SL, BMT 259, sta. CP-2-A, 45°46.3'N, 126°34.3'W, 2665 m, 15:II:1971; OSUO 2295, female, 92 mm SL, BMT 192, sta. CP-1-B, 45°39.4'N, 125°46.6'W, 2450 m, 19:III:1970; USNM 214593, immature, 40 mm SL, BMT 262, sta. CP-2-B, 45°38.3'N, 126°45.8'W, 2721 m, 17:II:1971; OSUO 2250, male, 60 mm SL, BMT 266, sta. CP-2-C, 45°17.5'N, 126°28.4'W, 2710 m, 18:II:1971; USNM

214595, female, 46 mm SL, BMT 288, sta. CP-1-WW, 44°06.2'N, 125°22.7'W, 2940 m, 14:VI:1972; CAS 33188, female, 82 mm SL, BMT 289, sta. CP-1-WW, 44°02.9'N, 125°23.8'W, 2926 m, 15:VI:1972.

Other Material: CAS 33190, female, 73 mm SL, BMT 270, sta. CP-2-E, 44°38.4'N, 126°42.0'W, 2850 m, 20:II:1971, poor condition.

Comparative Material: *Careproctus colletti* Gilbert. Syn-type, USNM 48698, male, 74 mm SL, ALBATROSS sta. 3338, 54°19'00"N, 159°40'00"W, 625 fm (1143 m), 28:VIII:1890; USNM 74735, two males, 209, 217 mm SL, ALBATROSS sta. 5029, southern Okhotsk Sea, 48°22'30"N, 145°43'30"E, 440 fm (805 m), 28:IX:1906.

Genus *Osteodiscus*, new genus

DIAGNOSIS.—Disk covered only by thin skin, skeletal; fleshy margin absent; supporting rays of disk webbed between the tips, attenuate posteriorly, the most posterior extending almost to anus; all apparently erectile; when erect an emarginate concave disk present. Nostrils single, relatively small. Cephalic pores very large. Pectoral fin deeply notched. Teeth sharp, with or without faint lobes. Branchiostegal rays six.

ETYMOLOGY.—From the Greek *οστέον*, (osteum), bony, and *δίσκος*, (discos), a disk; to be used as a masculine nominative.

TYPE-SPECIES.—*Osteodiscus cascadiae* Stein.

Osteodiscus cascadiae, new species

(Figure 9)

DIAGNOSIS.—Teeth in narrow bands of 18–24 oblique rows; head length 22.2–27.8% SL. Gill flap with four branchiostegals in margin; gill slit above pectoral and extending ventrally in front of an average of seven rays. Pectoral fin of 20–25 rays, none rudimentary, with moderately deep notch. Cephalic pores extremely large. Pyloric caeca absent.

DESCRIPTION.

Counts: Dorsal fin rays 49 (47–52), anal fin rays 42 (40–44), pectoral fin rays 23 (20–25), caudal fin rays 7 (6–7). Vertebrae 54 (51–56). Cephalic pores 2–6–7–1.

Morphometry: Head length 25.6 (21.7–27.8) % SL, body depth 19.6 (15.9–23.3), eye length 18.2 (13.3–22.2) % head length, upper pectoral fin-lobe length 67.5 (48.6–90.1), lower pectoral fin-lobe length 73.6 (56.6–90.1), snout to anus 92.9 (82.9–118.4), mandible to anus 83.3 (72.7–108.5), disk length 35.7 (26.4–43.5). Lower pectoral fin-lobe length 109.5 (86.2–137.3) % upper pectoral fin-lobe length.

Head large, snout blunt, protruding slightly

beyond premaxillary. Interorbital space slightly concave, rising abruptly to swollen occiput. Eyes black, pupils large. Bony orbital shape irregular, much wider ventrally, almost triangular. Nostrils single with raised rim or distinctly tubular, much smaller than nasal pores; located immediately anterior to orbit on horizontal through pupil. Maxillary reaching posteriorly to below rear of pupil. Mandible with distinct symphyseal knob. Postero-ventral angle of articular sharp, prominent. Teeth in small individuals (less than 40 mm SL) simple, sharp, slender, recurved; in larger specimens, inner teeth lanceolate. In all individuals, teeth arranged in narrow band of 18–24 oblique rows, each composed of up to seven teeth. Smaller specimens have fewer tooth rows. Tooth band narrows posteriorly but does not become uniserial. A distinct gap in teeth at junctions of maxillary and mandible. Gill slit above pectoral fin and extending ventrally to third to twelfth ray, usually in front of six to eight rays. Opercular flap very weak, easily distorted, supported dorsally by a single opercular spine, ventrally by four branchiostegals, the tips of which reach emarginate edge. Anterior cephalic pores extremely large; posterior cephalic pores about half as large. Anteriormost two mandibular pores completely separated in individuals less than about 45 mm SL; in larger individuals, these often conjoined by skin fold between anterior edges of pores.

Pectoral fins with moderately deep notch, not nearly reaching to fin base. Upper pectoral fin ray on a level between posterior of maxillary and lower margin of orbit, sometimes closer to one or other. Upper pectoral lobe usually slightly shorter than lower, reaching posteriorly to behind anal origin, of 14 (12–16) closely spaced rays. Rays of notch 4 (3–6), usually more widely spaced than upper pectoral lobe rays, but sometimes not clearly distinguishable. Rays of notch about equal in length except for dorsalmost and ventralmost rays. Ray tips not free but covered by skin and forming edge of fin in notch. Lower lobe of 4 (3–5) closely spaced rays, the ventralmost very short, almost completely webbed; the second longer, free for about half its length, the third abruptly longer, not quite as long as the fourth. Longest rays almost reaching anal origin.

Disk skeletal, bones covered only by skin, musculature very reduced. Disk large, relatively larger in individuals less than 40 mm SL. Pelvic girdle and all rays completely visible through skin (Fig. 9). All six supporting rays of disk produced

posteriorly; posteriormost three rays almost reaching anus. Anterior two rays finer, not as well developed as posterior four. Bases of anterior rays on anterior extension of pelvic girdle, a wide interspace between them and the four rays based on wider posterior portion. Posterior four rays straight from their bases to angles located at lateral edge of pelvic bone, at which point a sharp, ventrally oriented protrusion occurs; rays then angle sharply posteriorly. Disk covered by skin, tips of rays webbed. Posterior four rays erectile, rotating at their bases and at point of contact with outer edge of pelvic bone to form a concave, emarginate disk when erect. When relaxed, rays and skin lie flat against body wall. Anus immediately posterior to disk, slightly further from disk in individuals less than 30 mm SL. Small anal papilla in females, a prominent large one in males.

Body posterior to head gradually tapers to caudal fin; somewhat attenuate despite short dorsal and anal fins. Caudal fin very long, as much as one-seventh SL. Vertical fins one-fourth to one-third confluent with caudal fin.

Skin thin, tough, separated from body by layer of fluid. Rudimentary pores present, evenly spaced along lateral line. One specimen, OSUO 2068, with small papillae over entire head.

Prickles present on skin, in radiating clumps of nine to ten single, sharp, simple, spines embedded in a thick mucous layer covering entire body except inner surface of pectoral fins, lips, nostrils, and disk. Prickles deciduous, removable with mucous layer. Lost prickles represented by whitish pits.

Stomach located dorsally in body cavity; pyloric caeca absent.

Color of skin black or very dark brown in fresh specimens, fading to tan in alcohol. Oral and branchial cavities and peritoneum black. Stomach and gastrointestinal tract pale, streaked with black.

ETYMOLOGY.—From Cascadia Abyssal Plain, the location of known abundance off Oregon.

RELATIONSHIPS.—This genus and species are not closely related to any known liparids. The large (although skeletal) disk, short vertical fins, arrow-shaped teeth and well developed pectoral fins imply development from more primitive *Careproctus*.

REMARKS.—The utility of the extraordinary development of the disk in this species is unknown; it is not suited for attachment by suction

to any object. When erected, it may serve as some aid in swimming. The concave saucer created by the ventrad rotation of the rays may serve in "trimming" or adjusting body angle in relation to the substrate. I do not believe it provides increased ventral area for resting on soft sediments, because it is not likely that sediments are so soft that these fishes would sink into them.

The function of the prickles is likewise unknown; it is surprising, in view of the difficulties of calcium deposition at great depths, to find prickles. I do not believe the prickles are a sexual, seasonal, or solely adult character, as they occur on specimens of both sexes, of all sizes, taken throughout the year. The prickles' small size seems unlikely to deter potential predators.

DISTRIBUTION.—*Osteodiscus cascadiae* occurs from British Columbia south to at least Oregon, from 2195 to 3000 m. It is apparently absent from areas far offshore.

MATERIAL EXAMINED. *Holotype*: USNM 214619, female, 74 mm SL, BMT 119, sta. CP-1-E, 44°40.7'N, 125°35.9'W, 2779 m, 5:X:1969.

Paratypes: UBC 64-444, male, 64 mm SL, Gulf shrimp trawl, transect 6, sta. 4, 50°54.5'N, 130°06'W, 1200 fm (2195 m), 11:IX:1964; CAS 33214, female, 74 mm SL, BMT 277, sta. CP-3-A, 45°54.9'N, 127°33.2'W, 2765 m, 17:V:1971; USNM 214620, male, 57 mm SL, BMT 159, sta. CP-2-C, 45°16.6'N, 126°40.4'W, 2721 m, 18:I:1970; OSUO 2068, female, 80 mm SL, BMT 192, sta. CP-1-B, 45°39.4'N, 125°46.6'W, 2450 m, 19:III:1970; USNM 214623, CAS 33216, males?, 46, 64 mm SL, BMT 264, sta. CP-2-C, 45°20.8'N, 126°36.7'W, 2750 m, 17:II:1971; OS 5071, female, 85 mm SL, BMT 291, sta. CP-1-WW, 45°04.0'N, 125°23.8'W, 2940 m, 16:VI:1972; OSUO 2331, two specimens, immature, female, 37, 58 mm SL, BMT 336, sta. CP-3-D, 45°01.6'N, 127°31.0'W, 2850 m, 5:XI:1973; OS 5083, sex undetermined, 68 mm SL, BMT 287, sta. NAD 21, 44°48.8'N, 125°36.4'W, 2743 m, 8:III:1972; BCPM 75-203, OS 5088, BCPM 75-202, female, two males, 65, 69, 74 mm SL, BMT 120, sta. CP-1-E, 44°42.7'N, 125°33.0'W, 2825 m, 6:X:1969; BCPM 75-201, female, 81 mm SL, BMT 119, sta. CP-1-E, 44°42.5'N, 125°35.6'W, 2779 m, 5:X:1969; OSUO 1816, 1817, female, male, 72, 63 mm SL, OTB 112, sta. NH-65, 44°39.2'N, 125°35.3'W, 2810 m, 27:III:1966; OSUO 2033, female, 84 mm SL, BMT 70, sta. NH-65, 44°39.2'N, 125°30.3'W, 2830 m, 29:III:1969; OSUO 2334, female, 73 mm SL, BMT 271, sta. CP-2-E, 44°39.1'N, 126°41.9'W, 2832 m, 20:II:1971; CAS 33213, female, 71 mm SL, OTB 8, sta. NAD 22, 44°37.2'N, 126°09.0'W, 2800 m, 1:VI:1963; OSUO 2051, female, 71 mm SL, OTB 155, sta. NH-65, 44°35.8'N, 125°34.3'W, 2830 m, 10:I:1967; OSUO 2039, female, 71 mm SL, OTB X + 1, sta. NH-65, 44°31.3'N, 125°35.5'W, 2800 m,

2:X:1965; OS 5079, female, 76 mm SL, OTB 50, sta. NH-65, 44°28.4'N, 125°32.3'W, 2800 m, 13:I:1965; USNM 214622, female, 80 mm SL, BMT 290, sta. CP-1-WW, 44°06.4'N, 125°24.5'W, 2938 m, 15:VI:1972; CAS 33215, female, 83 mm SL, BMT 288, sta. CP-1-WW, 44°06.2'N, 125°22.7'W, 2940 m, 14:VI:1972; OSUO 2332, sex undetermined, 80 mm SL, BMT 288 MM, sta. CP-1-WW, 44°06.2'N, 125°22.7'W, 2940 m, 14:VI:1972; USNM 214621, female, 85 mm SL, BMT 292, sta. CP-1-XX, 43°46.3'N, 125°26.2'W, 2992 m, 16:VI:1972; OSUO 2333, immature, 27 mm SL, BMT 292, sta. CP-1-XX, 43°45.9'N, 125°26.3'W, 2992 m, 16:VI:1972; CAS 33217, male, 58 mm SL, BMT 294, sta. CP-1-XX, 43°45.6'N, 125°26.0'W, 3000 m, 17:VI:1972.

Other Material: OSUO uncatalogued, female, 72 mm SL, BMT 119, sta. CP-1-E, 44°40.7'N, 125°36.0'W, 2779 m, 5:X:1969.

Genus *Elassodiscus* Gilbert and Burke

Elassodiscus GILBERT AND BURKE, 1912a:81 (type-species *Elassodiscus tremebundus* Gilbert and Burke, 1912a, by original designation).

DIAGNOSIS.—*Elassodiscus* differs from all other liparid genera in having disk reduced to a lobate fleshy structure, lacking bony support. Teeth weakly or strongly trilobed. Pseudobranchiae absent. Branchiostegals six. Nostrils single. Pectorals notched, well developed. Disk very small, lobate, located in a pit or not, connected to pelvic girdle by connective tissue only. Pelvic girdle normal or reduced to cartilaginous plates. Gills 3½, no slit behind fourth arch.

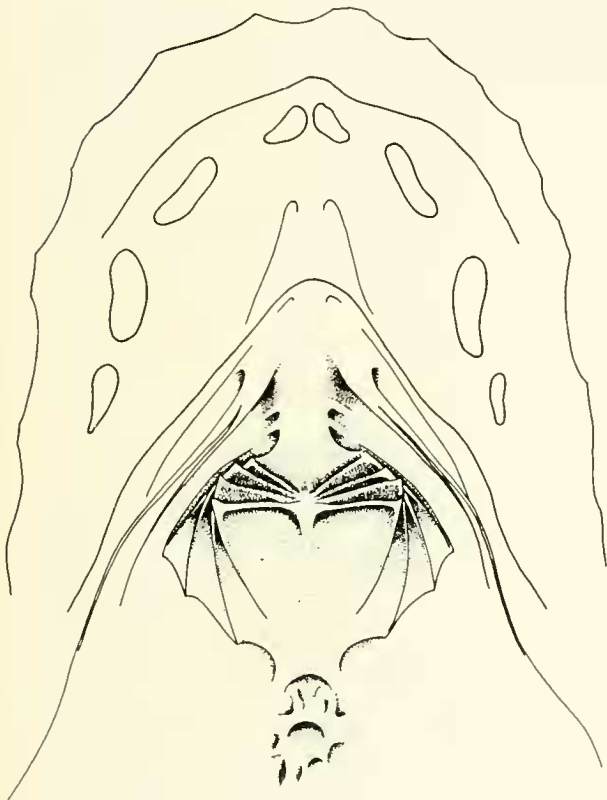
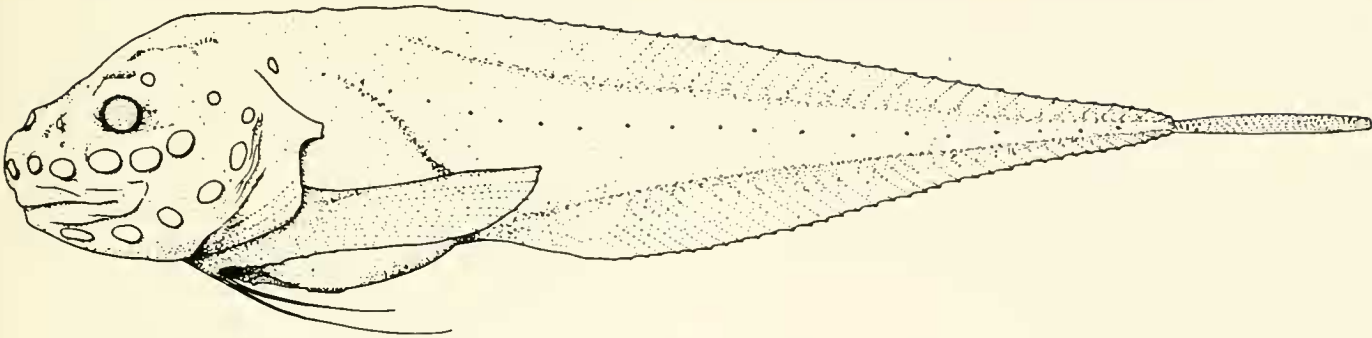
Elassodiscus caudatus Gilbert

(Figure 9)

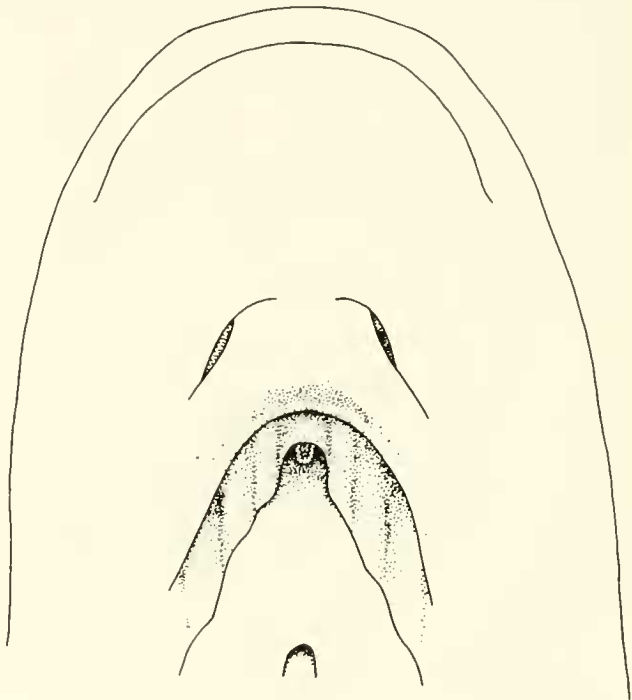
Paraliparis caudatus GILBERT, 1915:356, pl. 18, fig. 14 (original description of holotype, USNM 75815; distribution); JORDAN, EVERMANN, AND CLARK 1930:404; (distribution; synonymy); BURKE 1930:193, fig. 109 (description, distribution, in key); ALTON 1972:591, 610 (record); QUAST AND HALL 1972:31 (distribution, references).

DIAGNOSIS.—An *Elassodiscus* with disk more fully developed than that of *E. tremebundus*, but still rudimentary. Disk imperfect, consisting of about five fleshy lobes lacking bony elements, not located in a pit. Teeth trilobed, cruciform, especially in larger specimens. Dorsal fin rays 49–55, anal fin rays 45–50, pectoral fin rays 27–29.

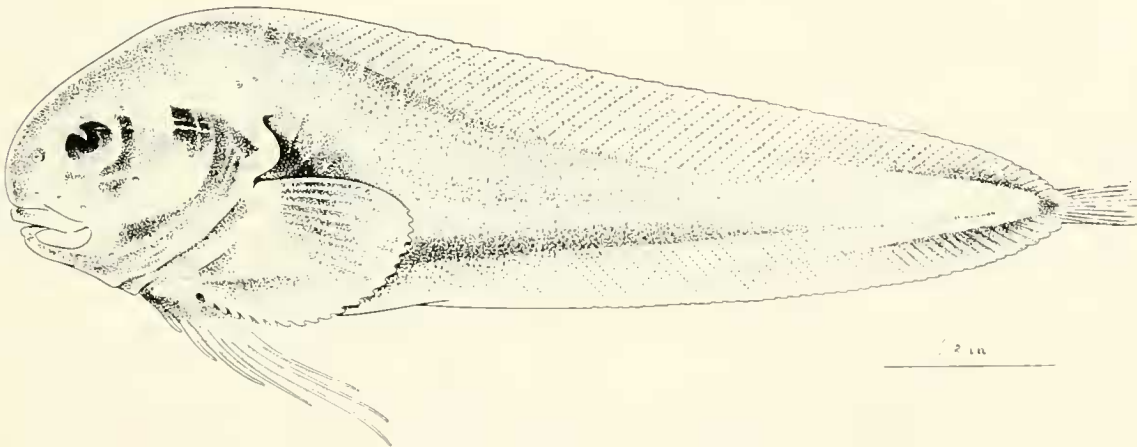
FIGURE 9. (top) *Osteodiscus cascadiae* Stein, new species. Holotype, USNM 214619, female, 74 mm SL, from off Newport, Oregon. Drawn by Paul Iwanaga. (middle left) *Osteodiscus cascadiae*. Ventral view of disk of holotype. Drawn by Paul Iwanaga. (middle right) *Elassodiscus caudatus* (Gilbert). Ventral view of disk of holotype. Drawn by Paul Iwanaga. (bottom) *Elassodiscus caudatus*. Holotype, USNM 75815, female, 75 mm SL, from Monterey Bay, California. From Gilbert (1915:pl. 18).



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DESCRIPTION.

Counts: Dorsal fin rays 55 (49–55), anal fin rays 48 (45–50), pectoral fin rays 28 (27–29), caudal fin rays 9. Pyloric caeca about 14. Vertebrae 60 (9–11 + 46–51). Cephalic pores 2–6–7–1.

Morphometry: Head length 25.8 (22.3–29.0) % SL, depth 21.1 (18.6–24.0); maxillary length 45.6 (40.5–50.0) % head length, eye length 21.2 (18.5–25.6), mandible to disk 45.3 (43.2–47.4), mandible to anus 17.6 (16.1–20.0), upper pectoral fin-lobe length 61.4 (52.1–73.2), lower pectoral fin-lobe length 118.3 (82.4–148.0), disk length 4.1 (1.2–5.8); upper pectoral fin-lobe length 53.0 (43.9–66.3) % lower pectoral fin-lobe length.

Head deep, anterior profile bluntly rounded. Occiput swollen, interorbital space slightly concave. Orbits large, round; eyes black with large pupil. Nostrils single, tubular, of moderate length, immediately anterior to eyes on a horizontal through pupil. Mouth horizontal, maxillary extending posteriorly to below rear of orbit. Teeth very strongly trilobed; in most prominent state, lateral lobes almost horizontal and teeth cross-shaped. Lobes least developed on posterior outer teeth, but still strong. Teeth arranged in 25–29 oblique rows of up to 10–11 teeth each, forming moderately wide band gradually narrowing posteriorly. Outer teeth smaller and closer together than inner teeth. Noticeable gap in teeth at maxillary and mandibular junctures.

Cephalic pores large, especially those associated closely with jaws.

Opercular flap supported by a single spine, located between horizontals through midpupil or lower margin of orbit. Gill slit short, completely above pectoral fin or extending ventrally in front of about two pectoral rays.

Pectoral fin deeply notched, divided into two very distinct lobes. Upper pectoral-ray level even with, or slightly below, ventral margin of orbit. Tips of all rays free. Lower lobe rays almost completely free, gradually increasing in length dorsally. Rays spaced closely in both lobes, but upper lobe rays increasingly distant from each other ventrally to lower lobe. No distinct rays of notch. Lower pectoral lobe about twice length of upper. Pectoral fin symphysis located far anteriorly, about under orbit.

Disk minute, almost on symphysis of lower pectoral lobes (Fig. 9). No evidence of any bony structure in disk; margin imperfect, very fragile,

consisting of about five fleshy lobes; sides of disk pressed together, difficult to separate.

Head and abdominal region heavy, deep, body behind body cavity tapering rapidly to caudal fin; not attenuate. Anus behind a vertical through tip of opercular flap. Anal papilla of male, OSUO 2059, consists of a simple stout papilla on a fleshy bump, located below gill opening. Dorsal fin origin behind a vertical through gill slit and anus. Skin thin, transparent, very loose, no rudimentary pores or lateral line evident.

Stomach located on left side of body cavity; pyloric caeca fat, pointed.

Skin colorless, with scattered melanophores posteriorly; body pale, with melanophores absent on head, denser on dorsal and anal fin bases. Mouth pale; branchial cavity, peritoneum, and stomach black; pyloric caeca pale. Branchial and peritoneal color plainly visible through sides of body.

RELATIONSHIPS.—As the second species referred to a hitherto monotypic genus, *E. caudatus* is most closely related to *E. tremebundus* Gilbert and Burke. *Elassodiscus caudatus* has a disk of five lobes, not located in a pit, vs. *E. tremebundus* which has a three-lobed disk in a pit; a longer lower pectoral fin lobe reaching the anal fin origin, vs. *E. tremebundus* which has a lower pectoral fin lobe not nearly reaching the anal fin origin; the lower pectoral fin rays almost entirely free, vs. *E. tremebundus* which has the lower lobe rays free for less than one half of their length; and strongly trilobed, cruciform teeth vs. *E. tremebundus* weakly trilobed teeth. The more normal disk, shorter vertical fins, and more strongly trilobed teeth indicate a relationship closer to *Careproctus* than that of *E. tremebundus*.

REMARKS.—Gilbert (1915) included *E. caudatus* in the genus *Paraliparis* because he did not discover the extremely minute disk, which is readily visible only when stained to provide contrast with the surrounding skin. The inclusion of *E. caudatus* in *Elassodiscus* leaves *P. dactylosus* as the only *Paraliparis* with trilobed teeth. *Elassodiscus* was described as differing from *Careproctus* and other disked genera in having a rudimentary disk of two to three lobes, lacking bony elements, and located in a deep pit. This species, possessing a rudimentary disk lacking bony elements but not located in a pit, narrows the division between *Careproctus* and

Elassodiscus. If a species were found with a bony lobate disk or a perfect disk lacking bony elements, I believe *Elassodiscus* would have to be synonymized with *Careproctus*.

DISTRIBUTION.—*Elassodiscus caudatus* has been captured between Monterey Bay, California, and southeast Alaska, between 335 and 616 m. This species is apparently distributed in a narrow latitudinal, but wide longitudinal, band along the continental slope.

MATERIAL EXAMINED. *Holotype*: USNM 75815, female, 75 mm SL, ALBATROSS sta. 4527, Point Pinos Light House, Monterey Bay, S 10°, W 8.5 miles (13.7 km), 183–337 fm (335–616 m), 26:V:1904.

Other Material: AB 62–486, two females, male, 58, 65, 67 mm SL, S of Juneau, Alaska, 58°01'N, 134°51'W, 338 fm (618 m), 2:XI:1962; OSUO 2059, male, 85 mm SL, OTB 567, sta. 310 H, 43°20.1'N, 124°46.6'W, 535 m, 30:X:1973; OSUO 2060, male, 41 mm SL, shrimp trawl, off Coos Bay, Oregon, 479–490 m, 23:IX:1974.

Comparative Material: *Elassodiscus tremebundus* Gilbert and Burke: Paratypes, SU 22387, three specimens, SU 22388 two specimens, sex undetermined, 180 to 220 mm SL, ALBATROSS sta. 4797, 52°37'30"N, 158°50'00"E, off Staritschkof Island, Avatcha Bay, Kamcharka, 682 fm (1248 m), 20:VI:1906.

Genus *Lipariscus* Gilbert

Lipariscus GILBERT, 1915:358 (type-species *Lipariscus nanus* Gilbert, 1915, by original designation).

DIAGNOSIS.—From the original description (Gilbert 1915): “No trace of a ventral disk. Vent posterior in position, lying in the area between the lower pectoral lobes. Pectoral fin greatly reduced, but the two lobes connected, not separate and distinct as in *Nectoliparis*. Teeth simple, in narrow bands. Branchiostegals 5 [sic]. Gill-slit narrow, confined to the suprapectoral region.”

Lipariscus nanus Gilbert

(Figure 10a)

Lipariscus nanus GILBERT, 1915:358, pl. 19, fig. 15 (original description of holotype, USNM 75817; distribution); JORDAN, EVERMANN, AND CLARK 1930:401 (distribution; synonymy); BURKE 1930:194, fig. 110 (description; distribution; in key); QUAIST 1968:486 (distribution); UENO 1971:98 (distribution); QUAIST AND HALL 1972:31 (distribution; references).

DIAGNOSIS.—*Lipariscus nanus* is distinguished from other liparids by possession of five branchiostegal rays, no disk, and posterior location of vent. Pectoral fin lower lobes connected. Teeth in narrow bands, simple. Gill slit completely above pectoral fin.

DESCRIPTION.

Counts: Dorsal fin rays 51 (50–52), anal fin rays 49 (47–49), pectoral fin rays 14 (13–15), caudal fin rays 4. Pyloric caeca about 6. Cephalic pores 2–6–7–1.

Morphometry: Head length 20.5 (18.3–22.2) % SL, body depth 18.2 (16.3–21.2); eye length 25.7 (22.9–28.2) % head length, mandible to anus 68.7 (64.5–76.2), upper pectoral fin-lobe length 63.3 (54.1–70.2), lower pectoral fin-lobe length (in females) 36.7 (31.2–44.9), (in males) 103.6.

Head small, bluntly rounded; lateral profile rising abruptly to level of upper orbit, then more slowly. Nostrils single, not tubular, just above horizontal through center of pupil. Eye large, orbit not near dorso-lateral outline of head. Cephalic pores slightly enlarged, mandibular symphyseal pair conjoined, or at most, only partially separated by a septum. Mouth small, narrow, inferior; maxillary reaching below posterior of pupil. Teeth simple, small canines forming narrow band in each jaw. Gill slit short, wholly above pectoral fin.

Pectoral fins with moderately deep notch; dorsalmost pectoral ray on horizontal through center of pupil. Upper pectoral fin lobe with 9 (9–10) rays which gradually decrease in length ventrally. Longest ray of upper lobe reaches anal origin. Rays of notch 2–3, more widely spaced than those in lobes; lower pectoral fin lobe with 2–3 rays. Tips of all pectoral fin rays free; rays of lower lobe free for up to one-half their length; longest lower pectoral lobe ray in females about one-third as long as in males.

Abdominal region of body stout. Body tapers slowly to caudal fin. Dorsal fin origin posterior to vertical through opercular flap; anal fin origin about below fourth dorsal fin ray. In adults, anus anterior to vertical through gill slit, located between lower pectoral lobes. In juveniles, more posterior; in an individual 13 mm SL, anus located at distal end of body cavity. Skin thin, loose, held well away from body by liquid as in *Nectoliparis pelagicus*. Caudal fin overlapped about one third by dorsal and anal fins.

Prickles present on males and females, evenly distributed over entire body, including pectoral fins. Prickles occur as single, long, thin, sharp spines, deeply embedded in skin for much of their length.

Stomach located left ventrally in body cavity; pyloric caeca short, fat, bluntly pointed.

Skin transparent, with scattered melanophores

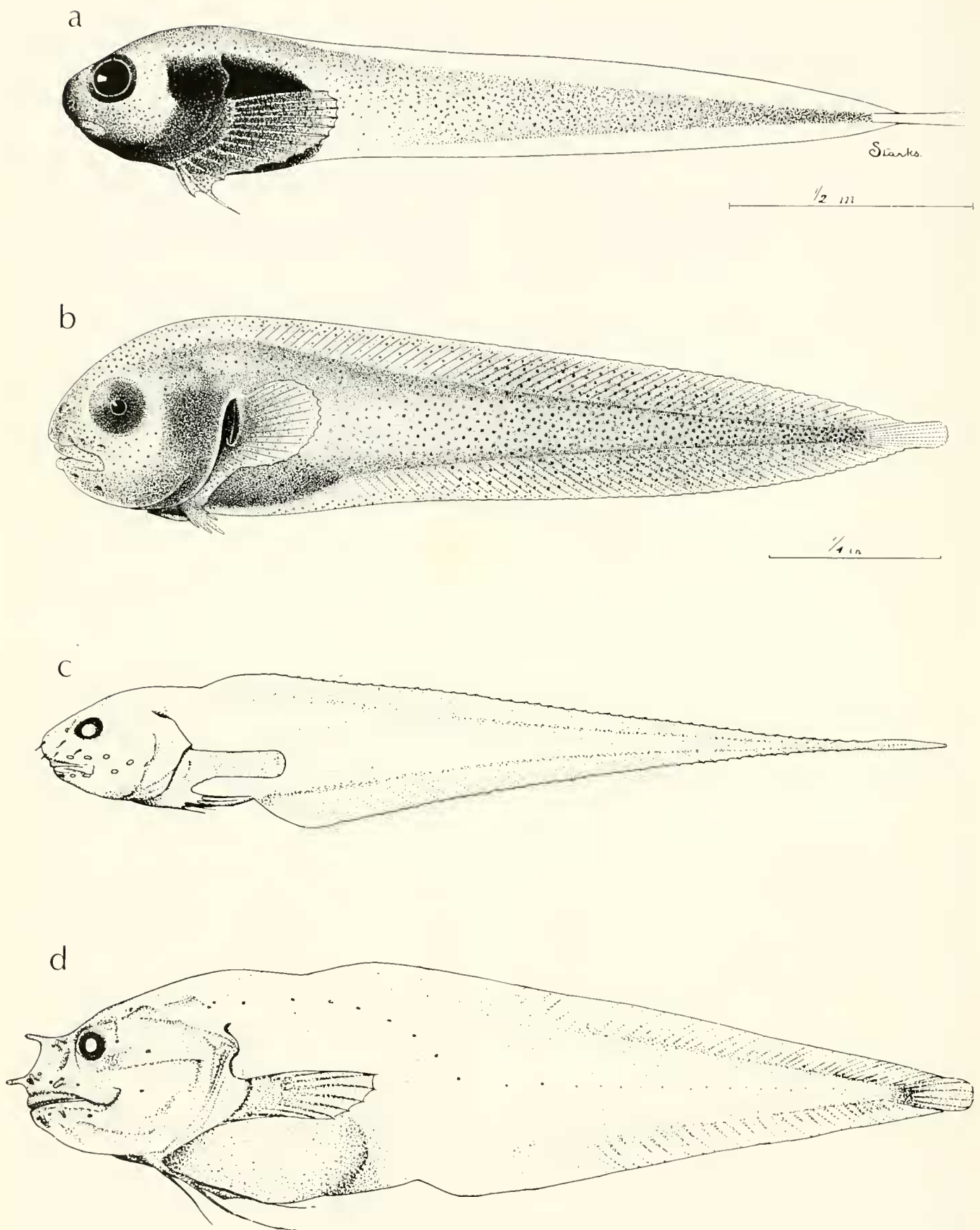


FIGURE 10. (a) *Lipariscus nanus* Gilbert. Holotype, USNM 75817, female, about 43 mm SL, from Monterey Bay, California. Drawn by Chloe Starks. From Gilbert (1915: pl. 19). (b) *Nectoliparis pelagicus* Gilbert and Burke. Holotype, USNM 74389, sex unknown, 28 mm SL, from between Attu and Medni Islands, Alaska. Drawn by W. S. Atkinson. From Gilbert and Burke (1912a: fig. 27). (c) *Rhinoliparis attenuatus* Burke. Composite drawn from four specimens (partially skinned), 62-110 mm SL, from off Oregon. Drawn by Paul Iwanaga. (d) *Odontoliparis ferox* new species. Holotype, USNM 214591, female, 231 mm SL, from off Oregon. Drawn by Paul Iwanaga.

which are more dense on caudal region; musculature pale with evenly distributed melanophores overall. Mouth, gill cavity, peritoneum, stomach, and pyloric caeca black.

DISTRIBUTION.—*Lipariscus nanus* occurs between Monterey Bay, California, and Alaska, but has not been recorded between Monterey and Vancouver Island. It is common in Monterey Bay (Eric Anderson, MLML, personal communication) and evidently also off Vancouver Island. It should occur in Puget Sound and off Oregon, but seems to be very rare in these areas; no specimens have been collected off Oregon in 12 years and 2200 midwater trawls.

MATERIAL EXAMINED. *Holotype*: USNM 75817, female, about 43 mm TL, ALBATROSS sta. 4461, Monterey Bay, Point Pinos Lighthouse, S 3°, E 9.3 miles (15.0 km) 285 fm (390 m), 12:V:1904.

Other Material: CAS 32327, immature, female, 13 mm SL, 54 mm SL, IFC sta. 1784C, 51°45'N, 130°24'W, 630–810 m, 10:XII:1939; CAS 32333, female, 43 mm SL, IFC sta. 1924B, 51°45'N, 130°24'W, 400–600 m, 3:I:1940; CAS 32331, female, 49 mm SL, IFC sta. 1901B, 51°32'N, 132°38'W, 400–600 m 7:II:1940; CAS 32328, immature, male, 21, 46 mm SL, IFC sta. 1808C, 51°30'N, 130°24'W, 560–720 m, 20:XII:1939; OSUO uncatalogued female, 48 mm SL, 2-m Tucker Trawl, Monterey Bay, 36°47.5'N, 121°54.5'W, 0–380 m, 2:V:1974.

Genus *Nectoliparis* Gilbert and Burke

Nectoliparis GILBERT AND BURKE, 1912a:82 (type-species *Nectoliparis pelagicus* Gilbert and Burke, 1912a, by original designation).

DIAGNOSIS.—Disk absent. Nostril single. Five branchiostegal rays. Gill slit restricted to front of pectoral fin. One suprabranchial pore present. Pyloric caeca present. Anus in individuals longer than 25 mm SL located on papilla extending anterior to pectoral symphysis, opening forward horizontally. In individuals less than 25 mm SL, anus normal.

Nectoliparis pelagicus Gilbert and Burke

(Figure 10b)

Nectoliparis pelagicus GILBERT AND BURKE, 1912a:82, fig. 27 (original description of holotype, USNM 74389; distribution); GILBERT AND BURKE 1912b:380 (record); GILBERT 1915:358, fig. 15 (record; distribution); BURKE 1930:189, fig. 106, 107, 108 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930: 402 (distribution; synonymy); BARNHART 1936:71, fig. 225 (description; distribution); SCHULTZ 1936:189 (distribution; in key); SCHULTZ AND DELACY 1936:135, 215 (distribution; synonymy); SCHMIDT 1950:216 (distribution; references); FOLLETT 1952:421 (partial description; record); WILIMOVSKY 1954:287 (distribution); MATSUBARA 1955:1197 (distribution; in key); WILIMOVSKY 1958:81 (dis-

tribution; in key); CLEMENS AND WILBY 1961:352, fig. 235 (description; distribution; in key); PEARCY 1964:87 (record); GRINOLS 1965:151 (distribution; synonymy); BAILEY ET AL. 1970:60 (listed); UENO 1971:98 (distribution); QUAST AND HALL 1972:31 (distribution; references); HART 1973:591, fig. (description; distribution; in key).

DIAGNOSIS.—*Nectoliparis pelagicus* differs from all other liparids in this combination of characters: five branchiostegal rays; no disk; gill slit restricted to front of pectoral fin. Anus in juveniles posterior to pectoral symphysis but, in adults, located anterior to pectoral symphysis on a forward pointing papilla.

DESCRIPTION.

Counts: Dorsal fin rays 54 (50–55), anal fin rays 49 (45–50), pectoral fin rays 20 (19–25), caudal fin rays 6. Pyloric caeca 7 (6–9).

Morphometry: Head length 22.5 (20.0–26.0) % SL, body depth 22.2 (18.3–25.7); mandible to anus 33.3–83.3 % head length in individuals between 18.0 and 60 mm SL.

The specimens examined fit the description given by Burke (1930:189) with the following exceptions: upper pectoral fin-lobe ray number 13–17, not 13–14; rudimentary pectoral fin rays present, in most cases filling the gap between upper and lower pectoral fin lobes; 3–5 rays in lower pectoral lobe. In individuals smaller than about 25 mm SL, anus located on a small papilla posterior to a line between bases of lower pectoral lobes, except in smallest individuals. In individuals longer than 25 mm SL, anus anterior to lower pectoral lobe bases. Pyloric caeca stout, blunt.

Body color in life tan, head and abdomen very shiny silver, body covered with scattered black chromatophores; skin transparent, well separated from body except on anterior of head and on caudal fin. The vermilion caudal fin spot mentioned by Follett (1952) was not seen; possibly it was a mating signal or the result of injury. In formalin or alcohol, silvery areas tend to fade to black; mouth and gill cavity brown or black, peritoneum black, stomach black, pyloric caeca pale.

DISTRIBUTION.—*Nectoliparis pelagicus* is common in Monterey Bay, California, above 500 m (Eric Anderson, MLML, personal communication), in Puget Sound, Washington (Bruce Frost, UW, personal communication), and off northwest Vancouver Island; it also occurs off southeast Alaska and Japan. It is probably distributed in neritic and protected waters through-

out the North Pacific Ocean north of about latitude 35°N.

MATERIAL EXAMINED. *Holotype*: USNM 74389, sex unknown, 28 mm SL, ALBATROSS sta. 4785 off Attu Island, Bering Sea, 53°20'N, 170°33'E, depth 1850 fm (3383 m), 12:VI:1906.

Other Material: USNM 132135, sex undetermined, 13 mm TL, ALBATROSS sta. 4750, off Tolstoi Point, southeast Alaska, 55°35'15"N, 132°33'00"W, 300 fm (549 m), 29:VIII:1905; CAS 32335, sex unknown, 21 mm SL, IFC sta. 1665B, 52°08'N, 131°54'W, 0–500 m, 13:XII:1938; CAS 32334, sex unknown, female, 24, 48 mm SL, IFC sta. 1646B, 52°00'N, 131°14'W, 0–280 m, 11:XII:1938; CAS 32336, male, 26 mm SL, IFC sta. 1741C, 52°00'N, 130°24'W, 0–390 m, 29:I:1939; CAS 32337, sex unknown, 18 mm SL, IFC sta. 1746C, 52°00'N, 131°14'W, 0–510 m, 30:I:1939; CAS 32339, female, 52 mm SL, IFC sta. 1895C, 51°54'N, 131°05'W, 0–900 m, 2:II:1940; CAS 32338, sex unknown, 20 mm SL, IFC sta. 1858C, 51°42'N, 132°19'W, 0–900 m, 16:I:1940; CAS 32340, female, 52 mm SL, IFC sta. 1916B, 51°30'N, 130°00'W, 0–260 m, 31:XII:1940; OSUO 2318, female, 35 mm SL, 1-m Tucker Trawl, off Shilshole, Puget Sound, 47°42.0'N, 122°27.1'W, 0–215 m, 12:II:1974; OSUO 155, female, 60 mm SL, MT 253, sta. AH-15, 46°14.6'N, 124°29.1'W, 0–200 m, 18:X:1962; OSUO uncatalogued, two females, 40, 44 mm SL, MT 568, sta. NH-50, 44°41.5'N, 125°19.1'W, 0–500 m, 12:XII:1964; OSUO 1138, male, 42 mm SL, MT 803, sta. NH-45, 44°38.6'N, 125°06.6'W, 0–200 m, 29:III:1966; OSUO uncatalogued, male, 25 mm SL, Monterey Bay, 36°47.2'N, 121°55.5'W, 0–500 m, 29:XI:1973.

Genus *Rhinoliparis* Gilbert

Rhinoliparis GILBERT, 1895:445 (type-species *Rhinoliparis barbulifer* Gilbert, 1895, by original designation).

DIAGNOSIS.—*Rhinoliparis* differs from other liparid genera in the presence of barbels only on the snout; absence of a sucking disk; simple or trilobed teeth; one suprabranchial pore; and six branchiostegal rays.

Rhinoliparis attenuatus Burke

(Figure 10c)

Rhinoliparis attenuatus BURKE, 1912a:573 (original description of holotype, MCZ 28377; distribution); GILBERT 1915:357 (short description; record); BURKE 1930:187, fig. 103 (description; distribution; synonymy); JORDAN, EVERMANN AND CLARK 1930:405 (distribution; synonymy); SCHULTZ 1936:189 (distribution; in key); SCHULTZ AND DELACY 1936:136, 215 (distribution; synonymy); WILIMOVSKY 1954: 287 (distribution); WILIMOVSKY 1958:80 (distribution; in key); GRINOLS 1965:154 (distribution; synonymy); DAY AND PEARCY 1968:2671 (record); QUAIST AND HALL 1972:32 (distribution; references).

DIAGNOSIS.—A *Rhinoliparis* with nine snout barbels; simple canine teeth arranged in narrow bands; and gill slit above pectoral fin or extending ventrally in front of one ray.

DESCRIPTION.

Counts: Dorsal fin rays about 68, anal fin rays about 60, pectoral fin rays 22 (21–23), caudal fin

rays about 2. Pyloric caeca 9–10. Cephalic pores 2–6–7–1.

Morphometry: Head length 19.1 (18.6–19.9) % SL, body depth 12.8 (12.6–13.0); eye length 26.5 (25.0–29.0) % head length, maxillary length 44.8 (44.2–45.4), snout to anus 102.4 (95.1–108.2), mandible to anus 80.1 (69.1–89.2), upper pectoral fin-lobe length 63.6 (61.9–66.7).

Head flattened, wider than deep, snout prominent, projecting well anterior to premaxillary. Nine barbels present on ventral surface of snout, darkly pigmented, long, pointed, easily lost. Nostrils single, tubular, medium length, even with horizontal through pupil. Eyes large, black; antero-dorsal orbital rim even with dorsal interorbital profile. Mouth inferior, wide; maxillary extending posteriorly to below posterior margin of orbit. Teeth small, simple canines, in oblique rows forming narrow bands in both jaws. Small cephalic pores present, posterior pores smaller; no evidence of rudimentary pores. Gill slit above pectoral fin, sometimes extending ventrally in front of base of one pectoral ray. Opercular flap irregularly triangular, supported by two spines, the upper stronger.

Pectoral fin shallowly notched. Level of upper ray between posterior of maxillary and lower margin of orbit; upper pectoral fin lobe of 11–12 rays, closely spaced; rays of notch 5–6, well developed, somewhat more widely spaced than upper lobe rays. Lower pectoral fin lobe of about five rays, tips free; reaches past anus but not to anal fin origin.

Body tapers very gradually to caudal fin, becoming extremely thin and fragile posteriorly. Anus located posterior to vertical through tip of opercular flap. Caudal fin very easily damaged; one specimen (OSUO 2265) has two caudal rays, conflicting with Burke (1912a; 1930:188) who stated, “apparently reduced to a single elongate ray.”

Stomach and pyloric caeca located left ventrally in body cavity. Pyloric caeca fat and long.

Color of skin transparent, dusky posteriorly; musculature tan; mouth, branchial cavity and peritoneum black; stomach and pyloric caeca pale.

RELATIONSHIPS.—*Rhinoliparis attenuatus* is not closely related to any known species. It is apparently only distantly related to *R. barbulifer* from which it differs markedly in having simple teeth (vs. strongly lobed) and more snout barbels (nine vs. two).

REMARKS.—*Rhinoliparis* specimens are extremely fragile due to their long, weak tails, poor ossification, and thin, fragile skin. All the specimens I examined were damaged, having lost vertical fin rays, some of the barbels and, in all but one case, the caudal fin.

This species was previously thought to have about seven barbels on the snout. Although none of my specimens had all the barbels present, I found that construction of a composite diagram of the barbels present on the specimens showed the presence of two more barbels.

DISTRIBUTION.—*Rhinoliparis attenuatus* is known from the Bering Sea, Alaska, Washington, Oregon, and Monterey Bay, California, between 362 and 2189 m. The new records listed here may greatly extend the known depth distribution. The deepest previously recorded capture was 1157 m (Gilbert 1915).

MATERIAL EXAMINED. OSUO 2267, OSUO 2265, female, male, 93, 110 mm SL, BMT 9 DWD, sta. DWD 5, 48°38.5'N, 127°00.0'W, 2189 m, 11:IX:1971; OSUO 761, male, 79 mm SL, OT, 44°38.8'N, 124°55.9'W, 700 m, 17:IV:1962; OSUO 847, female, 62 mm SL, OT 20, sta. W 40, 44°21.0'N, 124°56.2'W, 670 m, 8:VIII:1961.

Rhinoliparis barbulifer Gilbert

Rhinoliparis barbulifer GILBERT, 1895:445 (original description of holotype, USNM 84576; distribution); JORDAN AND EVERMANN 1898:2145 (description; distribution; synonymy; in key); EVERMANN AND GOLDSBOROUGH 1907:334 (distribution); GILBERT AND BURKE 1912b:379 (distribution; record); BURKE 1930:185, fig. 102 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930:405 (distribution; synonymy); SCHULTZ 1936:189 (distribution; in key); SCHULTZ AND DELACY 1936:136, 215 (distribution; synonymy); SCHMIDT 1950:215 (description; distribution; record); WILIMOVSKY 1954:287 (distribution); MATSUBARA 1955:1197 (distribution; in key); WILIMOVSKY 1958:80 (distribution; in key); GRINOLS 1965:155 (distribution; synonymy); UENO 1971:98 (distribution); QUAIST AND HALL 1972:32 (distribution; references).

DIAGNOSIS.—A species of *Rhinoliparis* with two snout barbels and strongly lobed teeth.

DESCRIPTION.—Burke (1930:185) provides an accurate description. Because *R. barbulifer* is very easily distinguished from *R. attenuatus*, no description will be included here.

DISTRIBUTION.—*Rhinoliparis barbulifer* is widely distributed throughout the North Pacific Ocean; it is known from Japan, the Bering Sea, the Sea of Okhotsk, Alaska, and California between 351–1053 m. It probably occurs off Oregon.

There is disagreement whether this is a

benthic or a pelagic species. Schmidt (1950:216) considers it “doubtless bathypelagic,” although Gilbert and Burke (1912b) considered it benthic. I believe it is probably benthopelagic because, although it has always been captured in bottom trawls, its pectoral fins do not seem well adapted for support if it rests on the bottom.

MATERIAL EXAMINED. *Syntypes*: SU 3092, males, 77, 88 mm SL, ALBATROSS sta. 3329, 53°56'50"N, 167°08'15"W, 399 fm (730 m), 21:VIII:1890.

Genus *Odontoliparis*, new genus

DIAGNOSIS.—A pelagic liparid with six branchiostegal rays; disk absent; pectoral fins reduced to two widely separated lobes of few rays. Large papillae present on head, located medially on snout and between pores of maxillary and mandibular cephalic canals. Teeth simple, large, slender, extremely sharp and highly recurved, depressible, arranged in oblique rows forming bands.

ETYMOLOGY.—From the Greek *ὀδόντος* (odontos), combining form of “a tooth,” and *λιπαρός* (liparos), sleek skinned; to be used as a masculine nominative.

TYPE-SPECIES.—*Odontoliparis ferox* Stein.

Odontoliparis ferox, new species

(Figure 10d)

DIAGNOSIS.—An *Odontoliparis* with pectoral fin of two widely separated lobes, the upper of 13 rays, the notch bridged by three widely spaced rudimentary rays reduced to stumps on cleithrum; about 12 oblique rows of teeth, of up to nine teeth each, forming moderately wide band on maxillary; gill slit wholly above upper pectoral fin lobe, the dorsal ray of which is on a horizontal below lower margin of orbit.

DESCRIPTION.

Counts: Dorsal fin rays 51, anal fin rays 46, pectoral fin rays 17, caudal fin rays 6. Pyloric caeca 7. Vertebrae 11 + 48. Cephalic pores 2–6–6–2. Six papillae on snout, four on mandible.

Morphometry: Head length 27.7% SL, body depth 24.8, snout to dorsal origin 28.8, snout to anal origin 40.7, eye length 15.6% head length, snout to anus (not including median papilla) 93.9, head width 79.4, mandible to anus 81.6, maxillary 55.6, upper pectoral fin-lobe length 45.2, lower pectoral fin-lobe length 60.2.

Head large and heavy. Snout blunt; lateral

profile appears angular due to two papillae located on the midline. Occiput swollen, sloping rapidly to concave interorbital space and uppermost snout papilla. Nostrils single, large, long, tubular, located midway on horizontal drawn between upper part of eye and upper median snout papilla. Mandible stout. Mouth very large, cleft extending to below rear of eye; end of maxillary distinctly posterior to eye, curved ventrally. Teeth large, slender, needlelike, highly recurved, forming band composed of about 12 oblique rows, each of 8–9 teeth at most, narrower posteriorly. Inner teeth largest, pivoted at bases, inwardly depressible. Gill slit wholly above pectoral fin, large, supported medially by a ventrally curved, blunt, bifid spine.

Cephalic pores with maxillary and mandibular pores enlarged, the remainder smaller. Two suprabranchial pores, the posterior of which forms the start of the lateral line. Rudimentary pores present on head.

Papillae present above premaxillary at symphysis and between pores of maxillary series anterior to eye. A prominent papilla on mid-line, above symphyseal papilla, the two separated by a distance equal to diameter of eye. Mandibular papillae four, two on each side, arranged similarly to those in maxillary series. Minute, simple papillae present on head, widely scattered, in no discernible pattern. Larger papillae on surface of lips, short, relatively thick, multifid distally, contacting surface of opposite lip with mouth closed.

Pectoral fins in two widely divided lobes, most dorsal pectoral ray on a horizontal drawn below orbit. Upper pectoral fin lobe of 11 rays with free tips. Lower pectoral fin lobe of three almost completely free rays, evenly graduated in length, the ventralmost shortest. Ventralmost two pectoral rays closer to each other than to the third. Rudimentary rays present between upper and lower lobes as knobs on pectoral girdle, not easily discernible without dissection. The two lower pectoral fin lobes widely separated by a distance about equal to length of gill slit, behind a vertical drawn through posterior end of maxillary.

Origin of dorsal fin about over gill slit. Body tapers evenly and gradually from occiput to caudal fin, not attenuate, but becomes increasingly dorso-ventrally flattened immediately posterior to head. Anus below gill slit. Skin very thin and fragile, loosely attached to body.

Rudimentary pores present, sparsely scat-

tered on body. Lateral line begins above gill slit and curves postero-ventrally to a point level with middle of upper pectoral lobe, the distance behind ray tips at that point about equal to eye diameter; the line then forms a straight line mid-laterally down body to caudal fin. Minute, simple papillae associated with each pore, but not found elsewhere except on head.

Stomach very large, located left centrally in body cavity. Pyloric caeca of two types. Four fat, medium long, pointed, and three cylindrical, blunt, with indentation or depression at end. Distal end of at least one pointed caecum attached to distal of a cylindrical caecum to form a loop. No internal connection apparent between the two caeca.

Color black, with pale musculature showing through except on head and abdomen; mouth and gill cavity blackish. Peritoneum black; stomach and pyloric caeca pale.

ETYMOLOGY.—From the Latin *ferox*, fierce.

RELATIONSHIPS.—The relationship of *Odontoliparis* to other liparid genera is unknown. The position of the pectoral insertion, the short vertical fins, the posterior position of the anus, and presence of two suprabranchial pores imply a divergence from a relatively primitive *Paraliparis*. Snout papillae or barbels are a convergent adaptation also present in *Rhinoliparis* and *Crystallias*, which are not closely related to each other.

REMARKS.—*Odontoliparis ferox* is an obviously predatory species, possibly distributed near, but not on, the bottom. Unfortunately there were no stomach contents to indicate where this species feeds. In many respects, such as the large, well-armed mouth, sooty-black color, weakly muscled body with reduced bony structure, and elongate pectoral rays, *O. ferox* is a typical pelagic predator. This single capture by a beam trawl is not necessarily an indication of capture on the bottom, as many abyssal pelagic species are occasionally captured in such trawls. The apparent rarity of this species is probably the result of a small, widely scattered population and net avoidance.

DISTRIBUTION.—The single known specimen of *O. ferox* was collected by beam trawl off Oregon in 2884 m of water. The species is possibly benthopelagic.

MATERIAL EXAMINED. *Holotype*: USNM 214591, female, 231 mm SL, BMT 335, sta. CP-3-D, 44°59.8'N, 127°29.2'W, 2884 m, 5:XI:1973.

Genus *Acantholiparis* Gilbert and Burke

Acantholiparis GILBERT AND BURKE, 1912a:83 (type-species *Acantholiparis opercularis* Gilbert and Burke, 1912a, by original designation).

DIAGNOSIS (modified from Burke 1930:188).—Disk absent; nostril single; teeth simple; one suprabranchial pore; pseudobranchiae absent; opercular arms projecting as strong spines from sides of head; gill flap supported by posterior arm of suboperculum; branchiostegal rays six.

Acantholiparis opercularis Gilbert and Burke

(Figure 11a)

Acantholiparis opercularis GILBERT AND BURKE, 1912a:83, fig. 28 (original description of holotype, USNM 74390; distribution); BURKE 1930:188, fig. 104 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930:401 (distribution; synonymy); GREY 1956:228 (distribution; synonymy); GRINOLS 1965:146 (distribution; synonymy); GRINOLS 1966:935, fig. 1 (description; distribution; record); GRINOLS 1969:1237, fig. 3, 4 (description; distribution); ALTON 1972:591, 610 (record); HART 1973:71, fig. (distribution; in key).

DIAGNOSIS.—An *Acantholiparis* without pyloric caeca and with even-sized, simple canine teeth near premaxillary juncture.

DESCRIPTION.—The descriptions by Grinols (1966, 1969) of this species are accurate with the addition of the following meristic ranges:

Counts: Dorsal fin rays 48 (45–52), anal fin rays 44 (38–47), pectoral fin rays 22 (20–23), caudal fin rays 8.

RELATIONSHIPS.—*Acantholiparis opercularis* is apparently closely related to *A. caecus* Grinols (1969), from which it can be distinctly differentiated by its lack of pyloric caeca and the absence of enlarged anterior premaxillary canines. Other differences may exist, but of the only two *A. caecus* available for comparison, one was in poor condition.

REMARKS.—Grinols (1969) distinguished *A. caecus* from *A. opercularis* partially on the basis of the first having “more median elements.” My examination of *A. opercularis* did not support his conclusion. I found that the range of variability of these elements in *A. opercularis* includes that of *A. caecus*. The reason for the difference in caudal ray counts between those given here and in Grinols (1966, 1969) is the presence of a procurrent caudal ray, which I did not include as a caudal ray, but which Grinols (1966, 1969) apparently included. Inclusion of this ray resulted in previous caudal ray counts being eight to nine.

The variability in median element number is greater in *A. opercularis* than in any other liparid species considered here. The female specimens examined encompassed the entire range of variation; not enough males were examined to allow a definite conclusion regarding their variability. Although *A. caecus* and *A. opercularis* are very similar, *A. caecus* was described from specimens of both sexes and cannot be a synonym of *A. opercularis*. Furthermore, none of the 63 *A. opercularis* identified for this study showed any tendency towards enlargement of anterior canine teeth or presence of pyloric caeca.

DISTRIBUTION.—*Acantholiparis opercularis* occurs from Kamchatka in 124 fm (227 m) to below the Gulf of Alaska and southward to the central Oregon coast. Grinols (1966) recorded a specimen from 1372 m off the Columbia River. No further specimens have been collected off Oregon from water this shallow, despite a large number of trawls made on the middle and lower continental slope. All other *A. opercularis* captured by Oregon State University were found between 1900 and 2997 m. I suggest that the specimen (which I have been unable to find) from 1372 m was either an atypical individual in its occurrence at that depth off Oregon or a specimen of *A. caecus*, a species which occurs in shallower water than *A. opercularis*.

MATERIAL EXAMINED. OSUO uncatalogued, female, 56 mm SL, OTB 259, sta. THB 19, 45°55.5'N, 125°30.1'W, 1900 m, 17:VII:1968; OSUO 1920, female, 64 mm SL, BMT 194, sta. CP-1-A, 45°55.2'N, 125°35.8'W, 1939–2122 m, 19:III:1970; BCPM 71-252, male, 69 mm SL, 45°40.5'N, 124°55'W, 9:I:1964; OSUO 2319, female, 68 mm SL, BMT 192, sta. CP-1-B, 45°39.4'N, 125°46.6'W, 2450 m, 19:III:1972; OSUO 2320, female, 60 mm SL, BMT 318, sta. CP-3-C, 45°28.4'N, 127°28.8'W, 2785 m, 3:II:1973; OSUO uncatalogued, females, 62, 49 mm SL, BMT 264, sta. CP-2-C, 45°20.8'N, 126°37.7'W, 2750 m, 17:II:1971; OSUO 2321, 2322, females, 70, 49 mm SL, BMT 190, sta. CP-1-C, 45°19.6'N, 125°45.8'W, 2597 m, 18:III:1970; OSUO uncatalogued, female, 58 mm SL, BMT 267, sta. CP-2-D, 44°58.2'N, 126°38.4'W, 2795 m, 18:II:1971; OSUO 2323, female, 56 mm SL, BMT 187, sta. CP-1-D, 44°55.4'N, 125°40.6'W, 2760 m, 17:III:1970; BCPM 71-225, female, 62 mm SL, OTB 155, sta. NAD 21, 44°35.8'N, 125°34.3'W, 2830 m, 10:I:1967; OSUO uncatalogued, male, sex undetermined, 49, 56 mm SL, BMT 291, sta. CP-1-WW, 44°04.0'N, 125°23.8'W, 2926 m, 15:VI:1972; OSUO uncatalogued, female, 61 mm SL, BMT 293, sta. CP-1-XX, 43°41.9'N, 125°30.0'W, 2997 m, 17:VI:1972.

Acantholiparis caecus Grinols

Acantholiparis caecus GRINOLS, 1969:1237, fig. 1, 2, 3, 4 (original description of holotype, USNM 202175; distribution); ALTON 1972: 591, 610 (distribution).

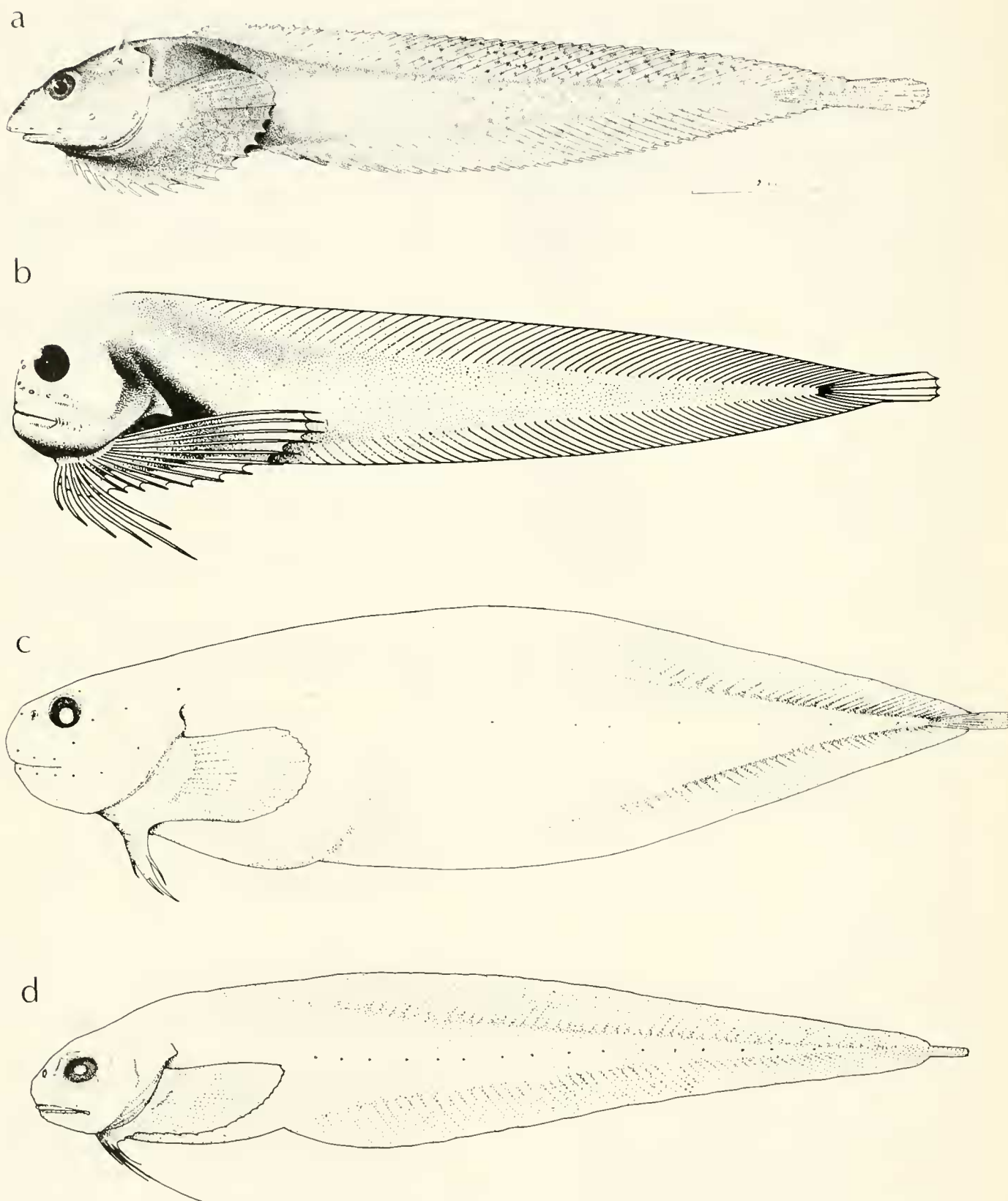


FIGURE 11. (a) *Acantholiparis opercularis* Gilbert and Burke. Holotype, USNM 74390, sex unknown, 76 mm TL, from off Kamchatka. Drawn by W. S. Atkinson. From Gilbert and Burke (1912a: fig. 28). (b) *Paraliparis mento* Gilbert. SU 22995, sex unknown, 63 mm SL, from Monterey Bay, California. Drawn by Chloe Starks. From Gilbert (1915: pl. 18). (c) *Paraliparis rosaceus* Gilbert. OSU 2069, female, 333 mm SL, from off Cape Lookout, Oregon. Drawn by Paul Iwanaga. (d) *Paraliparis paucidens* Stein, new species. Holotype, USNM 214618, male (partially skinned), 164 mm SL, from off Waldport, Oregon. Drawn by Paul Iwanaga.

DIAGNOSIS (the following is from the original description): "The new species differs from its congener, *A. opercularis*, by having well-defined pyloric caeca. . .; fewer premaxillary

teeth beginning anteriorly with a mesiad patch of teeth variously enlarged to greater than twice the size of those contained within the spatially separate and shortened posterior band. . .; more me-

dian meristic elements. The soft bodies of liparid fishes nearly preclude conclusive morphometric diagnosis; however, the new species appears to have a longer head and wider gill opening, more jaw overhang and a greater dorsal overlap on the caudal than its congener." (Grinols 1969.)

DESCRIPTION.

Counts: Dorsal fin rays 48–52, anal fin rays 43–45, pectoral fin rays 21, caudal fin rays 8. Pyloric caeca 4–6. Vertebrae 53–54.

Morphometry: Head length 22.7–24.0% SL, head width 17.1–22.8, body depth 10.8–14.0, gill slit length 5.1–5.8, length of jaw overhang 2.0–2.6, dorsal fin overlap on caudal fin 8.8–9.8, maxillary length 11.5–12.3, lower pectoral fin-lobe length 1.1–6.0.

"Body elongate, tapering, and covered with loose, unsquamated epithelium; maximum depth obtained midpectoral. Head and trunk region ventrally depressed. Gape extending posteriorly to a point below posterior margin of pupil. Pre-maxillary with two contrasting denticle patterns. Anterior mesiad denticle patch containing four to ten enlarged, recurved conical teeth, greater than twice the size of those within posterior band. Latter with uniformly sized fine conical teeth, recurved distally; eight to 11 rows in each band; one to seven teeth in each row. Mandible covered by enlarged band of uniformly sized, fine recurved conical teeth, comparable in size and shape to those in premaxillary band; 15–23 rows in each band; one to seven teeth in each row; occasional tooth displaced from pattern. Vomer and palatines edentate. Nostril tubular, darkly pigmented, and closer to eye than to tip of snout. Opercle entire, possessing four spines that lend support to opercular flap. Preopercle sculptured on ventral arm with three large, cavernous pores. Subopercle anteriorly originating loosely in skin between preopercle and ceratohyal (at about origin of the third branchiostegal ray); terminating posteriorly at preopercle-opercle articulation. Branchiostegals and more dorsally situated suboperculum folding together to collectively provide primary support for branchiostegal membrane; pseudobranchiae and thymus absent. Branchial aperture entirely above pectoral fin. Gill rakers discernible on lower arm of gill arch as rudimentary blunt knobs with distal spinous projections; no slit behind fourth arch. Dorsal origin above midpoint of pectoral fin (measured from lower insertion); anal fin beginning beneath eighth dorsal element.

Caudal fin elongate; last dorsal ray overlying less than one half length of fin. Pectoral fin unnotched; rays progressively shortened anteriorly; two ventralmost elements entire, free from fin membrane; intermediate elements more widely spaced than those on either side. Disc absent. Anus positioned beneath dorsal origin about midpoint of pectoral, anterior to origin of anal. Testes bilobed, positioned on either side of urinary duct, occupying posterior one-third of coelomic cavity. Four to five pyloric caeca developed . . . Head and body sparsely pigmented except for black on lips, fin emargination, and abdominal region; mouth, branchial chamber, peritoneum, intestine, and stomach all dusky. Live external coloration on head and body dusky red" (Grinols 1969). The sole known specimen (OSUO 2326) captured since the description of this species does not differ significantly from the above.

RELATIONSHIPS.—*Acantholiparis caecus* is closely related to *A. opercularis*, from which it differs in having enlarged canine teeth near the premaxillary juncture and pyloric caeca.

REMARKS.—Only one specimen (UW 17042, now BCPM 71–197) of the four listed by Grinols (1969) can be found. The other specimens, including the holotype, were apparently not deposited where indicated in the original description, as neither the USNM nor OSUO records indicate their reception. The sole available specimen of the type-series is in poor condition although good enough to verify the presence of pyloric caeca and the different dentition.

DISTRIBUTION.—*Acantholiparis caecus* occurs off the coast of Oregon on the continental slope between 1300 and 2122 meters. Presumably it will be found off northern California, Washington, and at least southern British Columbia. It apparently has a shallower depth distribution than *A. opercularis* and is limited to the intermediate and lower continental slope.

MATERIAL EXAMINED. *Paratype:* BC 71–197 (formerly UW 17042), female, 57 mm SL, AEC sta. 26, 70 foot shrimp trawl, 45°54'N, 125°05'W, 1554 m, 15:V:1963.

Other Material: OSUO 2326, male, 39 mm SL, sta. NAD 11C, epibenthic sled 067, 44°36.0'N, 125°11.0'W, 1372 m, 5:VII:1975.

Genus *Paraliparis* Collett

Paraliparis Collett, 1878:32 (type-species *Paraliparis bathybii* Collett, 1878, by monotypy).

Amitra Goode, 1881:478 (type-species *Amitra liparina* Goode, 1881, by monotypy).

Monomitra Goode, 1884:109 (replaces *Amitra*, preoccupied by *Amitrus* Schoenherr, 1840, Coleoptera: Insecta).
Gymnolycodes Vaillant, 1888a:40 (type-species *Gymnolycodes edwardsi* Vaillant, 1888a, by monotypy).
Hilgendorfia Goode and Bean, 1896:280 (type-species *Paraliparis membranaceus* GÜNTHER, 1887, by monotypy).
Eutelichthys Tortonese, 1959:226 (type-species *Paraliparis leptochirus* Tortonese, 1959, by designation).

DIAGNOSIS.—I have not studied all members of the genus; the diagnosis of Burke (1930:155) seems adequate at present: "Disk absent, nostril single; teeth trilobed to simple; suprabranchial pores apparently single in all the species; pyloric caeca present, in small numbers; pseudobranchiae absent; branchiostegals 6 [sic]."

REMARKS.—A short history of the genus follows:

Paraliparis was originally described by Collett (1878, 1880) as a subgenus of *Liparis* Artedi, but he recognized that it might be a new genus and provided a name "in case of a new generic designation becoming needful." The characters upon which Collett's designation was based were the absence of a disk and presence of a deeply notched pectoral fin with rudimentary rays in the notch.

Goode (1881) described a new genus and a species which he considered to be a cottid, *Amitra liparina*, "closely allied to the Liparidae," and related to, but more advanced than, *Cottunculus* and *Psychrolutes*. Goode stated that pseudobranchiae were present, but their presence has not since been demonstrated (Burke 1930:170). In 1884, Goode found that *Amitra* was preoccupied, necessitating its replacement with *Monomitra* Goode.

Gymnolycodes edwardsi Vaillant (1888a) was at first included in the Lycodidae, but in an appendix to the same volume it was placed in the Discoboli, and an affinity with *Careproctus* was suggested.

Günther (1887), correctly diagnosing the affinities of a new species, described *Paraliparis membranaceus* from one specimen of 60 mm TL. In 1896, Goode and Bean placed this species in a new genus, *Hilgendorfia*, because "its peculiarities seem sufficient to warrant its being set apart for further study before it is merged with *Paraliparis*." None of the characters given were sufficient for such a separation, and *Hilgendorfia* was subsequently reduced to a subgenus by Jordan and Evermann (1896), who included *P. ulochir* in it. At the same time, they

designated the subgenus *Amitrichthys*, in which they included *P. cephalus*, *P. rosaceus*, *P. mento*, *P. copei*, and *P. dactylosus*, all "distinguished by the very small gill openings, above pectorals." It is presently apparent that none of the three subgenera utilized by them (*Paraliparis*, *Amitrichthys*, and *Hilgendorfia*) accurately reflect relationships within the genus.

Burke (1930:154) synonymized *Monomitra* with *Paraliparis* and made no use of the subgeneric categories available. He also mistakenly listed the type-species of *Hilgendorfia* (subgenus) as *P. ulochir*, although, as used by Jordan and Evermann (1896), the only reason *P. membranaceus* was not mentioned was that it was outside the scope of their work. Although aware of *G. edwardsi* (listed in the appendix with comments), he did not examine it, and, presumably due to the poor original description and illustration, concluded that it did not belong in the Liparidae.

Eutelichthys leptochirus Tortonese (1959, cited in Cohen 1968) was originally described as the type of a new family, Eutelichthyidae, based upon the absence of a disk, the pectoral fins not extended dorso-ventrally, and anus located immediately anterior to the anal fin. However, on examination, Cohen (1968) found that both *E. leptochirus* and *G. edwardsi* are more properly placed in *Paraliparis*.

KEY TO SPECIES OF *Paraliparis*
FOUND IN THE STUDY AREA*

- 1a. Mouth oblique 2
- 1b. Mouth horizontal 3
- 2a. Upper pectoral ray above a horizontal through posterior of maxillary
..... *P. cephalus* (p. 39)
- 2b. Upper pectoral ray below a horizontal through posterior of maxillary
..... *P. mento* (p. 40)
- 3a. Teeth in a single series laterally, or apparently absent 4
- 3b. Teeth in bands at least three teeth wide; only uniserial far posteriorly, if at all .. 5
- 4a. Teeth uniserial, closely spaced blunt canines, in bands near symphysis only. No movable cartilaginous rod present postero-laterally on each side of mandible *P. rosaceus* (p. 41)

**Elassodiscus caudatus* has been included in this key because it may be very easily mistaken for a *Paraliparis*.

- 4b. Teeth apparently absent, reduced to four or five minute, simple canines on each side of premaxillary; a movable cartilaginous rod present postero-laterally on each side of mandible
..... *P. paucidens* (p. 43)
- 5a. Gill slit above pectoral fin and extending ventrally in front of at least ten rays ... 6
- 5b. Gill slit above pectoral fin and extending ventrally in front of no more than four rays 7
- 6a. Stomach pale, peritoneum black
..... *P. latifrons* (p. 45)
- 6b. Stomach dark, peritoneum silvery or pale, dotted *P. deani*(p. 47)
- 7a. Teeth lobed, or at least some teeth present with obvious lobes 8
- 7b. All teeth simple, none with lobes present 9
- 8a. Stomach pale *P. dactylosus* (p. 47)
- 8b. Stomach black; about 52 dorsal rays, 46 anal rays; disk present, minute
..... *Elassodiscus caudatus* (p. 26)
- 9a. Pectoral fin rays more than 27
..... *P. pectoralis* (p. 49)
- 9b. Pectoral fin rays fewer than 27 10
- 10a. Stomach pale; pectoral fin rays 18–22; head in SL 5.3 (5.0–5.7), body depth 6.6 (5.4–7.5) *P. rosaceus* (p. 41)
- 10b. Stomach black; body depth in SL 4.8–6.5 11
- 11a. Pectoral fin rays about 24, lower lobe of nine rays *P. ulochir* (p. 50)
- 11b. Pectoral fin rays 20 or fewer, lower lobe of five rays or fewer 12
- 12a. Middle pectoral fin rays elongate, free for most of their length, only webbed at bases. Dorsal fin rays 66–71, anal fin rays 63–75 *P. megalopus* (p. 50)
- 12b. Pectoral fin rays of notch not elongate, webbed to their tips. Dorsal fin rays 60, anal fin rays 53
..... *P. melanobranchus* (p. 52)

Paraliparis cephalus Gilbert

Paraliparis cephalus GILBERT, 1892: 561 (original description of holotype, USNM (apparently lost); distribution); GILBERT 1895:442, 469 (description; record); JORDAN AND EVERMANN 1898:2141 (description; distribution; synonymy; in key); EVERMANN AND GOLDSBOROUGH 1907:334 (distribution); GILBERT 1915:354 (description; record); TOWNSEND AND NICHOLS 1925:15 (record); BURKE 1930:177, fig. 94 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930:404 (distribution;

synonymy); BARNHART 1936:72 (description; distribution); SCHULTZ 1936:189 (distribution; in key); SCHULTZ AND DELACY 1936:136 (distribution; synonymy); GRINOLS 1965: 152 (distribution; synonymy; unverified record); ALTON 1972:591, 610 (record); QUAST AND HALL 1972:31 (distribution; references).

DIAGNOSIS.—A *Paraliparis* with mouth oblique; upper pectoral fin ray above level of posterior of maxillary; a wide notch at premaxillary juncture; and a prominent symphyseal knob on mandible.

DESCRIPTION.

Counts: Dorsal fin rays 55 (50–57), anal fin rays 50 (44–51), pectoral fin rays 16 (14–16), caudal fin rays 4 (not three as in Burke 1930:178). Pyloric caeca 6–10. Vertebrae 57–63 (9–10 + 47–54). Cephalic pores 2–6–7–1.

Morphometry: Head length 21.7 (20.4–23.3) % SL, body depth 19.6 (18.5–20.4); body depth 90.9 (83.3–100.0) % head length, eye length 23.3 (22.2–26.3), maxillary length 52.6 (50.0–58.5), snout to anus 83.3 (76.9–83.3).

Head large, snout blunt, lateral profile rising rapidly and evenly to swollen occiput. Eyes large, black, with large pupils; orbital outline extending almost to dorsal profile. Nostrils single, moderately large, not tubular, located immediately anterior to orbits above a horizontal line drawn through pupil. Cephalic pores very large, closely spaced except at symphysis of mandible.

Mouth at an angle, not horizontal, maxillary extending beneath posterior of eye. At premaxillary juncture a prominent notch present into which mandibular symphyseal knob fits when mouth closed. Posterior of articular with sharp ventral angle just posterior to vertical through orbit. Teeth small, simple, recurved, sharp, arranged in short, oblique rows forming narrow bands; inner teeth larger. Very wide notch separating teeth bands on premaxillaries at juncture, a much narrower notch present at mandibular symphysis.

Gill slit above pectoral fin; due to destruction of membrane distally connecting branchiostegals to body wall, gill slit often apparently extends ventrally in front of ten rays to a point anterior to symphysis of lower pectoral lobes.

Pectoral fin deeply notched; level of upper pectoral ray between posterior of maxillary and lower margin of orbit. Upper pectoral fin lobe consisting of eight to ten rays; about equal in length to lower; several short, but well devel-

oped widely spaced rays in notch between lobes, ray tips free; lower pectoral lobe of two to four rays, free for most of their length. Upper pectoral fin-lobe rays reaching posterior to anal fin origin, those of lower lobe not reaching it.

Body narrows abruptly posterior to gill slit; dorsal fin origin above or slightly anterior to gill slit. Caudal fin of four rays, not three as described by Burke (1930:178), about one-third overlapped by dorsal and anal fins. Skin lax, thin.

Stomach and pyloric caeca left ventrally located in body cavity; pyloric caeca long, finger-like, evidently highly variable in number.

Skin transparent, musculature pale, with scattered melanophores, especially dense near dorsal and anal fin bases; mouth pale or light tan; gill cavity blackish; peritoneum and stomach black; pyloric caeca pale.

RELATIONSHIPS.—*Paraliparis cephalus* is distinguished from most liparid species primarily by its oblique mouth, a character it shares with *P. mento* and *P. angustifrons* of the Pacific, and *P. garmani* of the North Atlantic. It is most similar to the last, from which it differs in having enlarged cephalic pores (normal-sized pores in *P. garmani*); teeth in narrow bands (vs. teeth in wide bands); 14–16 pectoral rays, none rudimentary (vs. pectoral of 21 rays with rudimentary notch rays); and a black stomach (vs. a pale stomach).

REMARKS.—The original description describes the gill slit position as above the pectoral fins, “the membrane connecting the branchiostegal rays with the shoulder girdle very delicate and easily ruptured, broken in all but one of the specimens” (Gilbert 1892). Most of the specimens I examined showed no evidence of this membrane; however, several had remnants of it. Most specimens captured will possess apparently larger gill slits, the result of tears in this membrane during capture.

DISTRIBUTION.—*Paraliparis cephalus* has been reported from southern California, Oregon, Washington, and the Bering Sea. It is found on the continental slope between 524 and 1384 m.

MATERIAL EXAMINED. *Syntypes*: SU 21, sex unknown, lengths unknown, ALBATROSS sta. 2892, 34°15'00"N, 120°36'00"W, 284 fm (519 m), 5:I:1889, disintegrated.

Other Material: BCPM 71–9, female, 73 mm SL, off northern British Columbia, 52°07.2'N, 131°27.6'W, 584 fm (1068 m), 17:IX:1971; BCPM 71–203, female, 79 mm SL, sta. AEC 24, 45°35'N, 124°53'W, 750 fm (1372 m), 28:V:1964; OSUO 743, 744, males, 71, 61 mm SL, OTB 120, sta. NAD 10, 44°34.2'N,

124°50.0'W, 640–650 m, 8:VI:1966; OSUO 2289–2291, two females, male, 65, 84, 79 mm SL, BMT 369, sta. CBT 310 F, 43°27.8'N, 124°53.6'W, 900 m, 4:VII:1974; OSUO 2288, male, 82 mm SL, CSUH OTB, off Cape Mendocino, Calif., 40°11'30"N, 124°57'30"W, 960 m, 26:I:1973; SU 5254, females, 63 (broken), 66 mm SL, ALBATROSS sta. 3112, Monterey Bay, 37°08'00"N, 122°47'00"W, 296 fm (541 m), 12:III:1889; SU 23004, females, 53, 82 mm SL, ALBATROSS sta. 4334, off Point Loma Lighthouse, Calif., 33°30'E, 13.6 miles (21.9 km), 514–541 fm (940–990 m), 9:III:1904.

Comparative Material: *P. garmani* Goode and Bean. *Holotype*, USNM 64129, sex undetermined, not measured, ALBATROSS sta. 2586, 39°02'40"N, 72°40'00"W, 328 fm (600 m), 20:IX:1885; MCZ 38313, sex undetermined, 124 mm SL, CAP'N BILL II, sta. 185, 42°22'N, 64°55'W, 290–340 fm (530–622 m), 15:VII:1953; MCZ 38285, 11 specimens, sex undetermined, CAP'N BILL II, sta. 165, 42°42'N, 63°47'W, 360–370 fm (658–677 m), 12:VII:1953.

Paraliparis mento Gilbert

(Figure 11b)

Paraliparis mento GILBERT, 1892:562 (original description of holotype, USNM 44298; distribution); JORDAN AND EVERMANN 1898:2142 (description; distribution; synonymy; in key); GILBERT 1915:354, pl. 18, fig. 12 (description; record); BURKE 1930: 179, fig. 95, 96 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930:404 (distribution; synonymy); SCHULTZ 1936:189 (distribution; in key); SCHULTZ AND DELACY 1936:136 (distribution; synonymy); GRINOLS 1965:153 (distribution; synonymy).

DIAGNOSIS.—A *Paraliparis* with mouth oblique; origin of upper pectoral ray below a horizontal through posterior corner of maxillary; and anus on a vertical through posterior corner of maxillary.

DESCRIPTION.—The specimens examined agree well with the description given by Burke (1930:179) with the following exceptions:

Counts: Dorsal fin rays 55–59, anal fin rays about 49–51, pectoral fin rays 16–18, caudal fin rays 5. Pyloric caeca 6–8. Vertebrae 61 (9–10 + 51–52). Cephalic pores 2–5–5–?

Morphometry: Body depth 16.4–20.8% SL, head length 15.4–20.8, snout to vent 10.5–14.7; eye length 22.2–33.3% head length (highly variable due to difficulty of measurement), maxillary length 47.6–50.0% head length [Burke (1930:179): “a little more than one half the head”], longest ray of lower pectoral fin lobe 80.4–116.1.

Symphysis of mandible very prominent, fitting (when mouth closed) in wide, toothless gap at juncture of premaxillaries. Nostril with very slightly raised rim.

Pectoral fin upper ray below a horizontal

through posterior of maxillary; symphysis of pectoral fins anterior to vertical through anterior orbital margin. Tips of upper pectoral fin-lobe rays free; lower pectoral fin-lobe rays mostly free, length increasing evenly dorsad. Anus position most posterior in SU 22995 (63 mm SL), smallest individual examined. Pyloric caeca of variable shape, from short, fat, to long, blunt.

Color probably pink in life; skin transparent, with small melanophores widely scattered at least on head. Mouth and gill cavities blackish or dusky; peritoneum brownish or black; stomach pale, pyloric caeca pale.

RELATIONSHIPS.—Probably most closely related to *P. cephalus*, from which it differs in having a much lower pectoral fin and more anterior location of the pectoral fin symphysis.

DISTRIBUTION.—*Paraliparis mento* is known from Washington, Oregon, and northern California south to Monterey Bay; it is probably present off British Columbia. It occurs between 800 and 1000 m on the continental slope.

MATERIAL EXAMINED. *Holotype*: USNM 44298, sex unknown, 3¼ inches TL (original description), ALBATROSS sta. 3071, off the coast of Washington, 47°29'00"N, 125°33'30"W, 685 fm (1253 m), 28:VI:1889, very poor condition.

Other Material: SU 22995, sex undetermined, 63 mm SL, ALBATROSS sta. 4512, Monterey Bay, Point Pinos Lighthouse, S 23°, E 9 miles (14.5 km), 469 fm (857 m), 23:V:1904; OSUO 2264, female, 95 mm SL, OTB 225, 44°36.8'N, 124°56.3'W, 800 m, 15:I:1968; OSUO 2268, female, 114 mm SL, CSUH OTB, off Cape Mendocino, Calif., 40°11'30"N, 124°57'30"W, 960 m, 26:I:1973.

Paraliparis rosaceus Gilbert

(Figure 11c)

Paraliparis rosaceus GILBERT, 1890:93 (original description of holotype, USNM 48918; distribution); GARMAN 1892:80 (description; distribution); GOODE AND BEAN 1896:525 (distribution); JORDAN AND EVERMANN 1898:2142 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930:404 (distribution; synonymy); BURKE 1930:182, fig. 100 (description; distribution; synonymy; in key).

Paraliparis grandiceps GARMAN, 1899:117, pl. 29, fig. 4-4e (original description of holotype, MCZ 28701; distribution); BURKE 1930:183, fig. 101 (description; distribution; synonymy; in key).

DIAGNOSIS.—A *Paraliparis* with short, simple canine teeth, in small individuals arranged in bands, in large adults almost uniserial; head length 18.9 (17.2–20.8) % SL, head depth about equal to head width; pectoral fins deeply notched, of 18–22 rays, notch rays often rudimentary in adults.

DESCRIPTION.

Counts: Dorsal fin rays 61 (57–64), anal fin rays 55 (54–59), pectoral fin rays 20 (18–22), caudal fin rays 6 (6–8). Pyloric caeca 7 (6–9). Vertebrae 68 (67–71). Cephalic pores 2–6–7–1.

Morphometry: Head length 18.9 (17.2–20.8) % SL; depth of head at occiput (58.8–76.9) % head length, maxillary length 40.0 (34.5–50.0), eye length 24.4 (14.7–23.3), upper pectoral fin-lobe length 76.9 (52.6–83.3), lower pectoral fin-lobe length 58.8 (43.5–83.3), snout to anus 100.0 (83.0–111.0), mandible to anus 90.0 (71.4–111.0).

Head heavy, low; snout blunt, abrupt, extending slightly anterior to premaxillary. Dorsal profile sloping gradually up from snout to occiput. Nostrils single, lacking raised rim in individuals less than 150 mm SL, with prominent raised rim in individuals greater than 250 mm SL; located a distance about equal to eye diameter anterior to orbit, on a horizontal line through pupil. Eye round, black, not prominent. Mouth broad, maxillary extending posteriorly to below rear of eye, its posterior blade deeply buried beneath gelatinous flesh. In specimens greater than 300 mm SL, mandible distinctly included, upper lip greatly overhanging maxillary. Teeth small, simple, stout. Tooth size gradually decreases towards mandibular symphysis. In specimens less than 100 mm SL, teeth arranged in both jaws in oblique rows which form moderately wide band, which becomes uniserial posteriorly. Largest individuals with scattered teeth in biserial or triserial arrangement at symphysis only. Teeth about same relative size in small and large individuals. Anterior cephalic pores enlarged, postocular, supraocular, and suprabranchial pores reduced. Symphyseal mandibular pore pair usually in common pit. Gill slit completely above pectoral fin or extending ventrally in front of one ray. Opercular flap supported by a broad posteriorly curved spine, which is deeply buried in soft tissue in large individuals.

Pectoral fins deeply notched, more deeply in larger specimens. Dorsal most ray of pectoral fin about even with lower margin of orbit or pupil. Upper pectoral fin lobe evenly rounded, emarginate, of 14 (13–16) rays. In large specimens, rays embedded deeply in watery flesh. Pectoral fin notch not as deep in smaller specimens; (individuals less than 100 mm SL have extremely distinct rays in outline of fin notch; in specimens greater than 200 mm SL rays of notch easily discernible only by dissection). Individuals greater

than 250 mm SL often with rays of notch reduced to rudiments consisting of ray bases only. Lower lobe of three (two to four) rays, the first very short, embedded in flesh in large specimens; more dorsal rays of pectoral fin abruptly longer, of about equal length.

Dorsal and anal fins increase in height posteriorly to a point about two thirds of SL posteriorly, then taper rapidly to caudal fin. In small specimens, body elongate, no deeper than head; in largest individuals, much deeper than head. Fin rays at dorsal origin deeply buried in gelatinous flesh; first dorsal ray above gill slit or posterior to it.

Body in small specimens long, rounded in cross section; in large individuals body massive, covered with a very thick gelatinous layer below skin, especially on head, fins, and abdomen. Caudal fin about two-thirds confluent with dorsal and anal fins. Skin thin, fragile. Rudimentary pores present along lateral line to caudal fin, more closely spaced posteriorly; pores also present on pectoral fins, and scattered widely over tail.

Stomach very large, thick walled and muscular; pyloric caeca long, robust, bluntly pointed.

Skin color dark brown in small individuals; in specimens over 100 mm, snout brownish or black, body rosy or pinkish, fins dark edged. Oral cavity dusky; gill cavity and peritoneum black. Stomach and pyloric caeca pale.

RELATIONSHIPS.—*Paraliparis rosaceus* is one member of a group of species described as having uniserial dentition present at least on the mandible; this group includes *P. rosaceus*, *P. grandiceps*, *P. copei*, *P. attenuatus*, and *P. wilsoni*. Of these, *P. wilsoni*, *P. grandiceps* and *P. attenuatus* are known only from the holotypes, of which the last two are in extremely poor condition. The original descriptions of both *P. grandiceps* and *P. attenuatus* fit *P. rosaceus*. My examination of the holotypes of the two showed that *P. grandiceps* is a synonym of *P. rosaceus*, and *P. attenuatus* is apparently not. *Paraliparis attenuatus* differs in having uniserial dentition in the young and slightly more pectoral rays (24 vs. 22).

Paraliparis copei, which occurs in the North Atlantic Ocean, is very similar to *P. rosaceus*. It differs in having uniserial dentition in both jaws (vs. *P. rosaceus* premaxillary teeth in bands), a shorter head (14.4–17.1 vs. *P. rosaceus*, 17.2–20.8), apparently more vertebrae (71–73 vs. 67–71 in *P. rosaceus*), and in lacking secondary pores (which are present in *P. rosaceus*). Its

color is also different, the skin being white or transparent, with snout and fin tips blackish; *P. rosaceus* adults are brownish or pinkish, with a dark snout and fins, and juveniles are dark overall.

REMARKS.—Tooth pattern is very important in the description of *P. rosaceus*. The premaxillary teeth have been removed from the holotype. Although the original description (Gilbert, 1890) states: "teeth in upper jaw apparently paved" (i.e., in bands), Burke (1930:182) describes the holotype as having "teeth . . . in the lower jaw in one row, forming a single cutting edge, teeth in upper jaw nearly absent, probably similar to the teeth in the lower jaw." I feel that the tooth arrangement in the holotype was probably biserial anteriorly and uniserial posteriorly, as indicated by the few biserially arranged teeth in large (greater than 250 mm SL) specimens, and the uniserially arranged posterior teeth in small (less than 100 mm) specimens.

The holotype of *P. grandiceps* was almost completely dissected (apparently by Garman), and has subsequently disintegrated further. At present it consists of the damaged skull, cleithra, left half of the lower jaw, miscellaneous bones, and a section of the tail. One of the most significant features revealed by the remaining dentary is the diminution in size of the teeth towards the symphysis. A comparison of the remains with a skeletal preparation of an Oregon specimen (OSUO 2292) revealed no significant differences. I therefore consider *P. grandiceps* a junior synonym of *P. rosaceus*.

From the original description, *P. attenuatus* could be synonymous with *P. rosaceus*. It differs primarily in having 24 pectoral rays (maximum in *P. rosaceus* is 22 rays), and in having uniserial dentition at 75 mm TL (*P. rosaceus* of this size have teeth in bands). The holotype (MCZ 28700) is missing both upper and lower jaws and is in very poor condition. I do not believe *P. attenuatus* can presently be considered synonymous with *P. rosaceus*. More specimens of the former would clarify the relationship of the two species.

DISTRIBUTION.—*Paraliparis rosaceus* is known from Oregon, central California, Baja California, and the Gulf of California between 1799 and 3358 m. I expect its occurrence off British Columbia, Washington, and southern Mexico. I believe this species may occur in equatorial regions and off South America be-

cause conditions at its depths of occurrence may not be significantly different in those areas.

MATERIAL EXAMINED. *Holotype*: USNM 48918, immature or male, 135 mm SL, ALBATROSS sta. 2919, off southern California, 32°17'00"N, 119°17'00"W, 984 fm (1799 m), 17:I:1889.

Other Material: OSUO 2064, male, 299 mm SL, BMT 257, sta. CP-2-A, 46°02.2'N, 126°31.0'W, 2706 m, 15:II:1971; OSUO 2311, immature, 65 mm SL, BMT 195, sta. CP-1-A, 45°57.5'N, 125°46.2'W, 2265 m, 20:III:1970; MCZ 50976, female, 288 mm SL, BMT 323, sta. CP-3-A, 45°56.4'N, 127°39.1'W, 2763 m, 13:III:1973; MCZ 50977, USNM 214611, immature, 91, 79 mm SL, BMT 194, sta. CP-1-A, 45°55.5'N, 125°38.8'W, 2122 m, 20:III:1970; CAS 33201, immature, 68 mm SL, BMT 158, sta. CP-2-A, 45°48.2'N, 126°28.7'W, 2651 m, 17:I:1970; OS 5086, immature, 51 mm SL, BMT 89, sta. THB 19, 45°44.6'N, 125°26.7'W, 2225 m, 14:VII:1969; OSUO 2069, female, 333 mm SL, BMT 192, sta. CP-1-B, 45°39.6'N, 125°48.8'W, 2450 m, 19:III:1970; OS 5090, immature, 63 mm SL, BMT 263, sta. CP-2-B, 45°36.4'N, 126°44.8'W, 2730 m, 17:II:1971; OSUO 2308, immature, 75 mm SL, BMT 91 MM, sta. CP-1-B, 45°30.3'N, 125°32.6'W, 2377–2483 m, 15:VII:1969; OSUO 2065, male, 281 mm SL, BMT 280, sta. CP-3-C, 45°21.6'N, 127°35.7'W, 2800 m, 18:V:1971; MCZ 50975, male, 266 mm SL, BMT 264, sta. CP-2-C, 45°20.8'N, 126°37.7'W, 2750 m, 17:II:1971; CAS 33204, immature, 52 mm SL, BMT 190, sta. CP-1-C, 45°19.6'N, 125°45.8'W, 2597 m, 18:III:1970; OSUO 2292, female, about 350 mm SL, BMT 159, sta. CP-2-C, 45°16.5'N, 126°40.4'W, 2721 m, 18:I:1970; OS 5094, female, 361 mm SL, BMT 324, sta. CP-3-C, 45°12.4'N, 127°32.5'W, 2809 m, 14:III:1973; MCZ 50978, immature, 61 mm SL, BMT 188, sta. CP-1-D, 44°58.5'N, 125°44.3'W, 2792 m, 17:III:1970; USNM 214609, male, 285 mm SL, BMT 269, sta. CP-2-D, 44°57.6'N, 126°40.0'W, 2706 m, 19:II:1971; CAS 33202, immature, 63 mm SL, BMT 95, sta. CP-1-D, 44°56.1'N, 125°35.3'W, 2706 m, 16:VII:1969; OSUO 2310, OS 5076, OS 5075, male, females, 71, 287, 248 mm SL, BMT 187, sta. CP-1-D, 44°55.4'N, 125°40.6'W, 2760 m, 17:III:1970; USNM 214610, female, 82 mm SL, BMT 229, sta. TP-1, 44°45.8'N, 131°23.8'W, 3358 m, 31:V:1970; OSUO 2309, female, 78 mm SL, BMT 161, sta. CP-2-D, 44°53.5'N, 126°30.7'W, 2770 m, 19:I:1970; USNM 214608, female, 321 mm SL, BMT 286, sta. NAD 21, 44°50.2'N, 125°32.5'W, 2758 m, 8:III:1972; OSUO 2307, female, 254 mm SL, BMT 254, sta. CP-2-E, 44°39.2'N, 126°43.3'W, 2800 m, 30:IX:1970; OSUO uncatalogued, male, 63 mm SL, BMT 270, sta. CP-2-E, 44°38.4'N, 126°42.0'W, 2850 m, 20:II:1971; CAS 33203, immature, 58 mm SL, BMT 291, sta. CP-1-WW, 44°04.0'N, 125°23.7'W, 3100 m, 15:VI:1972; CAS 31496, female, 321 mm SL, sablefish trap, Monterey Bay, 36°42.8'N, 122°06.8'W, 1755–1926 m, 17:IX:1974; MCZ 28701 (*holotype*, *P. grandiceps*) sex unknown, ca. 10 inches (original description), ALBATROSS sta. 3434, Gulf of California, 25°29'30"N, 109°48'00"W, 1588 fm (2904 m), 21:IV:1891, dissected and subsequently disintegrated.

Comparative Material: *Paraliparis attenuatus* Garman. *Holotype*, MCZ 28700, 75 mm TL, ALBATROSS sta. 3364, off Panama, 5°30'00"N, 86°08'30"W, 902 fm (1650 m), 27:II:1891. *Paraliparis copei* Goode and Bean. *Holotype*, USNM 35637, female, about 160 mm SL, ALBATROSS sta. 2237, 39°12'17"N, 72°09'30"W, 520 fm (951 m), 13:IX:1884, poor condition; SU 9555, sex undetermined, 70 mm TL, ALBATROSS sta. 2586, off Cape May, New Jersey, 39°02'40"N, 72°40'00"W, 328 fm (600 m), 20:IX:1885; USNM 186151, female, 137 mm SL, DELA-

WARE cruise 59–10, no. 16, off Massachusetts, 39°47.0'N, 70°57.0'W, 800 fm (1463 m), 27:VIII:1959; VIMS 03116, females, 123, 150 mm SL, sta. 49, 36°41.5'N, 74°37.4'W, 743 m, 9:VI:1973. *Paraliparis wilsoni* Richards. *Holotype*, USNM 198201, female, 215 mm SL, GERONIMO cruise 2, sta. 240, 04°08'S, 10°08'E, 1134 m, 9:IX:1963.

Paraliparis paucidens new species

(Figures 11d, 12)

DIAGNOSIS.—A species of *Paraliparis* which differs from all other known species of the genus in the lack of mandibular teeth and low number of premaxillary teeth.

DESCRIPTION.

Counts: Dorsal fin rays 58–60, anal fin rays 53, pectoral fin rays 19–24, caudal fin rays 6–8. Pyloric caeca 8. Vertebrae 67. Cephalic pores unknown.

Morphometry: Head length 17.0–18.2% SL, body depth 13.2–14.1, eye length 3.7–3.8; body depth 71.4–83.3% head length, head width 55.6–58.8, eye length 20.4–21.3, upper pectoral fin-lobe length 62.5–71.4, mandible to anus 43.5–55.6, snout 23.2–26.3, maxillary length 41.7, lower pectoral fin-lobe length 100.0–111.0% upper pectoral fin-lobe length; depth at occiput 83.3–90.0% body depth.

Head low, depth at occiput less than maximum depth. Interorbital space very wide, slightly concave; dorsal margins of orbits higher than interspace. Bones of head extremely soft, poorly ossified in both specimens. Eyes large, black, pupils small. Nostrils single, short, with prominent raised rim, not close to eyes. Mouth broad, short, maxillary reaching posteriorly to below anterior of eye. Lips thick, fleshy, upper thicker than lower. Four or five minute, stout canines point inward on inside surface of each side of maxillary. No teeth on mandible. Cutting edge of each jaw formed of skin-covered cartilage. A wide flap of skin (oral valve) stretches across vomerine area posterior to maxillary; another flap, not as wide, present inside mandible. Laterally extended patch of papillae present on inside surface of maxillary juncture; fewer papillae present on inside surface of mandible. Thick, posteriorly tapered, movable cartilaginous rod present mid-laterally on each side of mandible, tip reaching oral cleft. Extra fold of skin attached to each rod possibly allows erection lateral to mandible, enlarging gape (Fig. 12). Cephalic pores enlarged, those on mandible larger than on maxillary. Anterior three mandibular pores on

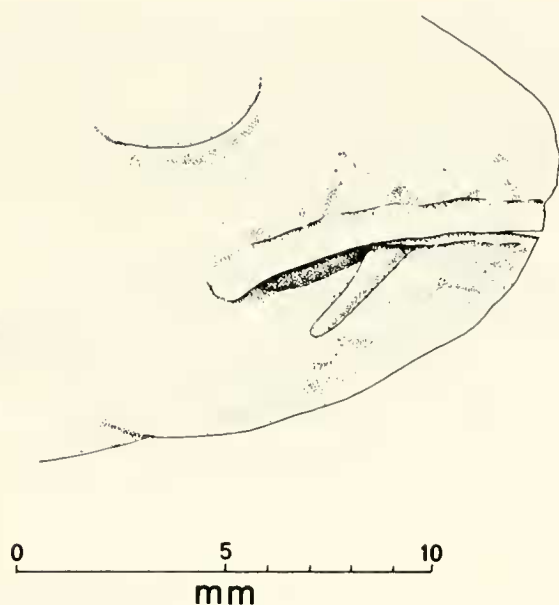


FIGURE 12. Lateral view of accessory mandibular rod of *Paraliparis paucidens* Stein, new species; posterior of rod pulled down to show more clearly. Drawn from holotype, USNM 214618, by Paul Iwanaga.

each side much more ventral in location than normal in other *Paraliparis*. Pore number not ascertainable, only three pores present on each side of mandible itself. Rudimentary pores present over entire head and mandible in a pattern obscured by damage to specimens. Gill rakers sharp, stout based, evenly tapered to tips. Gill slit above pectoral fin, short. Opercular flap bluntly triangular.

Pectoral fins bilobed, deeply notched; notch abrupt, length along pectoral girdle variable. Dorsalmost pectoral ray even with lower margin of pupil or lower margin of orbit. Upper pectoral fin lobe of 10–18 rays, closely spaced, about two thirds of head length, not reaching anal fin origin. Pectoral rays in notch short, not rudimentary, more widely spaced than upper or lower pectoral fin-lobe rays. Lower pectoral fin lobe of 3–4 rays; about as long as upper lobe; more dorsal lower lobe rays free for most of their length.

Body low, slowly tapering to caudal fin, round in cross section anteriorly, but becoming dorso-ventrally compressed posterior to abdominal cavity. Anus location anterior, almost between bases of ventralmost pectoral fin rays, about under posterior margin of orbit. Dorsal fin origin well behind gill slit and pectoral fin bases. Anal fin origin beneath fifth to seventh dorsal ray. Caudal fin about one-half confluent with dorsal and anal fins. Skin extremely thin and lax, very easily

torn; in life, probably well separated from body by fluid layer. Rudimentary pores present on lateral line, evenly spaced, probably also scattered over entire body.

Stomach and pyloric caeca located left ventrally in body cavity; stomach large, thick walled; pyloric caeca fat, of varied lengths but none very short.

Skin dark brown, head and snout darker; mouth and gill cavity dusky or black, peritoneum dark brown or black; stomach and pyloric caeca pale.

ETYMOLOGY.—From the Latin *paucus*, few, and *dens*, tooth.

RELATIONSHIPS.—*Paraliparis paucidens* seems to be the most specialized member of the liparid branch composed of species with uniserial dentition in the adults: *P. copei*, *P. attenuatus*, *P. wilsoni* and *P. rosaceus*. *Paraliparis paucidens* closely resembles these species in its meristic and morphometric characters and is especially close to *P. rosaceus*, but it differs from these four species in having highly reduced dentition and accessory mandibular rods. Although *P. paucidens* possesses only a few teeth, they are similar to those of the above four species.

REMARKS.—*Paraliparis paucidens* is a typical species of *Paraliparis* despite the presence of the accessory mandibular rod and reduced dentition. Because of its very close relationship to the four previously mentioned species, I consider the erection of a new genus for this species inadvisable. The paucity of teeth in this species is the conclusion of a trend present in the abovementioned group of related species.

The function of the accessory mandibular rods is unknown; perhaps they help to support the edges of the mouth or to laterally enlarge the gape. Lacking effective dentition, this species probably nips off soft parts of animals or ingests whole organisms. The unfortunate lack of stomach contents in both specimens examined precludes any statement about feeding habits.

DISTRIBUTION.—*Paraliparis paucidens* is known only from off Oregon between 1536 and 2086 m. Its distribution probably extends to Washington and California.

MATERIAL EXAMINED. *Holotype*: USNM 214618, male, 164 mm SL, OTB 41, sta. WH 45, 44°21.9'N, 125°14.4'W, 2086 m, 14:VII:1964.

Paratype: CAS 33212, male, 131 mm SL, off Tillamook Head, Oregon, 45°50'N, 128°06'W, 1536 m, 16:VI:1966.

***Paraliparis latifrons* Garman**

(Figure 13)

Paraliparis latifrons GARMAN, 1899:120, pl. 27–28, fig. 2–2f (original description of syntypes (seven), MCZ 28698; distribution); BURKE, 1930:174, fig. 91 (description; distribution; synonymy; in key).

DESCRIPTION.

Counts: Dorsal fin rays 56 (54–57), anal fin rays 50 (48–50), pectoral fin rays 22 (21–24), caudal fin rays 6 (5–6). Pyloric caeca 7 (6–10). Vertebrae about 61. Cephalic pores 2–6–7–1.

Morphometry: Head length 22.1 (19.7–24.9) % SL, body depth 18.6 (17.1–21.5); body depth 84.6 (76.9–93.3) % head length, maxillary length 54.4 (45.6–59.1), mandible to anus 79.2 (63.3–94.9), upper pectoral fin-lobe length 80.1 (61.9–104.5), lower pectoral fin-lobe length 86.0 (63.9–103.5).

Head deeper than body; snout blunt, almost vertical; dorsal cephalic profile not as abrupt, rising evenly to occiput. Eyes moderately large, dark. Nostrils single, with raised rim, small, obscure, on horizontal through center of pupil, about diameter of pupil anterior to eye. Mouth horizontal, large, broad; maxillary extending posteriorly to below rear of orbit. Teeth of medium size, sharp, recurved canines, in about 14 oblique rows of up to four teeth each; forming very narrow band which becomes uniserial far posteriorly. Inner teeth and teeth nearest symphysis of jaws larger. Wide gap present at premaxillary juncture, a narrower one at mandibular symphysis. Cephalic pores extremely large. Suprabranchial pore not reduced, as large as anterior mandibular pores. Gill opening very long, starting above pectoral, extending ventrally in front of 9–15 rays. Tips of all branchiostegal rays enter outline of opercular flap, which has a distinctive emarginate edge.

Level of dorsalmost ray of pectoral fin between horizontals through lower margin of orbit and posterior of maxillary. Pectoral fin deeply notched, almost to base; upper lobe of 14 (13–17) rays, closely spaced, tips apparently free, reaching to or behind anal fin origin. Rays in pectoral fin notch distinct, much more widely spaced and shorter than rays in either upper or lower lobe, free for up to one half of their length. Lower pectoral fin lobe of 4 (4–5) almost entirely free, very long and filamentous rays; the longest reaches past anal fin origin. Ventralmost pectoral ray short; next ray dorsad abruptly much longer, upper rays of lobe gradually increasing in length.

Upper and lower pectoral lobe lengths variable, about equal. Symphysis of lower pectoral fin lobes below posterior of maxillary.

Body tapers abruptly behind head, then more slowly posterior to abdominal region. Dorsal fin origin above gill slit. Amount of caudal fin confluence with anal and dorsal fins unknown. Skin extremely thin and fragile. No evidence of rudimentary pores present, although their occurrence seems likely.

Stomach and pyloric caeca located left ventrally in body cavity. Number of pyloric caeca highly variable. Pyloric caeca distinctive, usually extremely short, almost absent; appearing as conical protuberances at pylorus of stomach, some evident only as slight evagination of stomach wall.

Skin color dark brown, especially on head; gill cavity, mouth and peritoneum black; stomach and pyloric caeca pale.

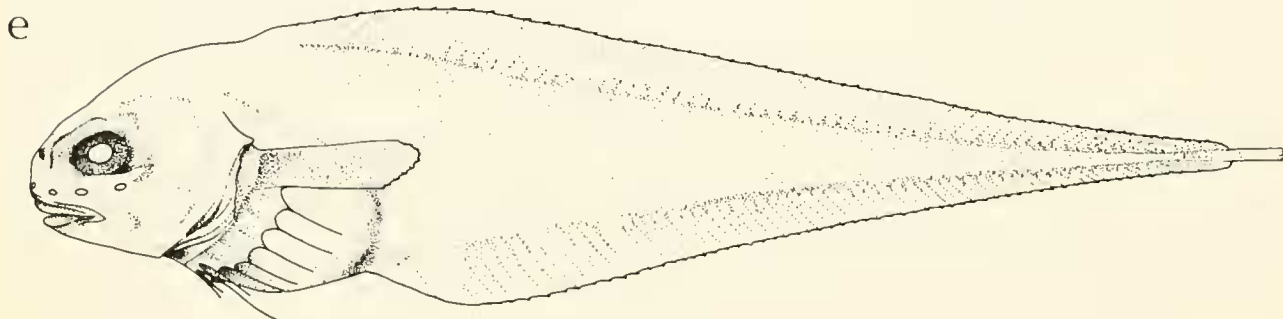
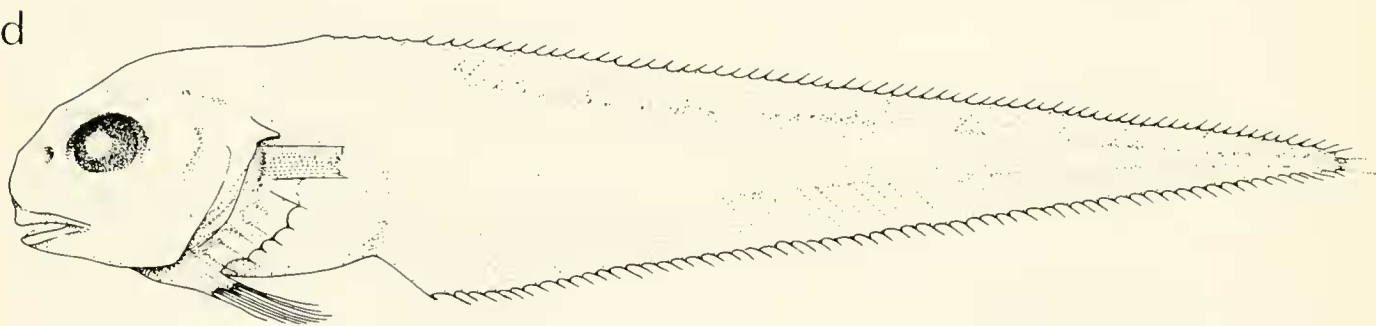
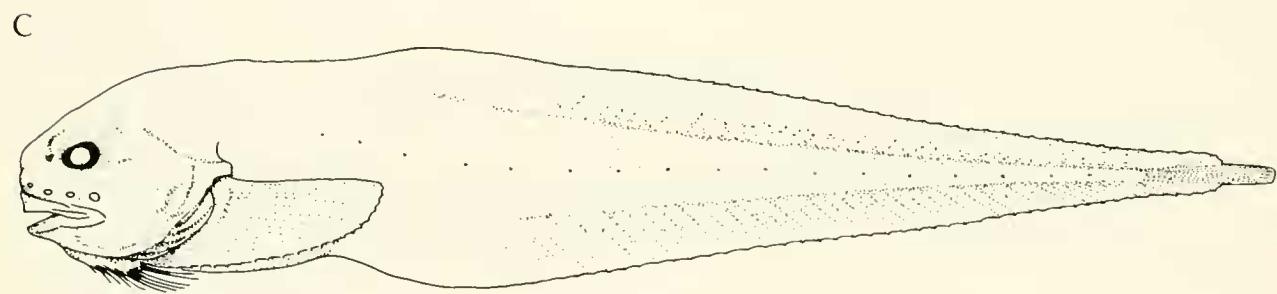
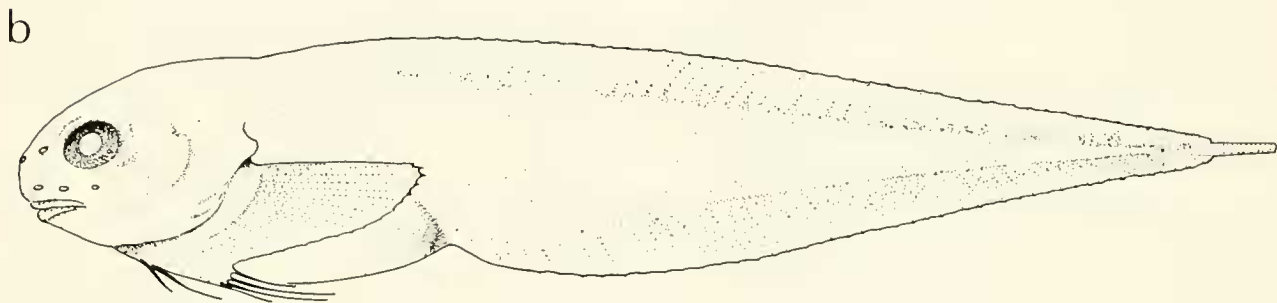
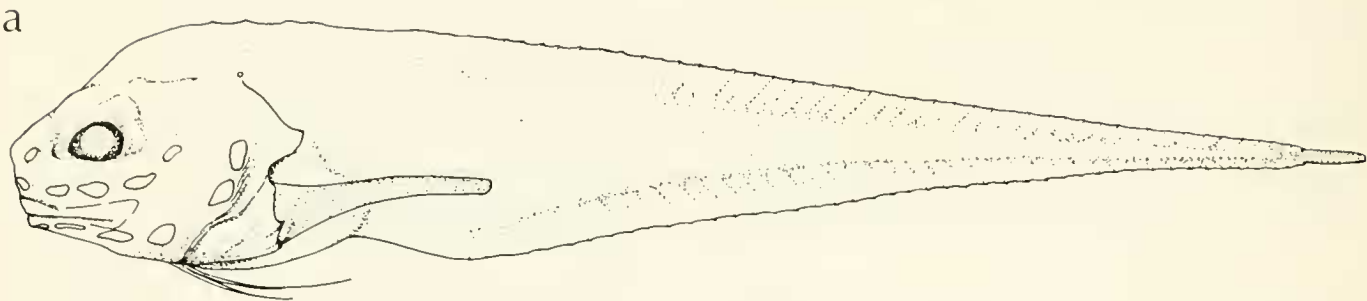
RELATIONSHIPS.—*Paraliparis latifrons* is most closely related to *P. holomelas* Gilbert, from which it differs in having a pale stomach (vs. *P. holomelas* dark stomach), and fewer dorsal (54–57 vs. 58–61) and anal (48–50 vs. 54) fin rays.

REMARKS.—The syntypes of *P. latifrons* are in very poor condition; the heads of five of the seven specimens have fallen off, and the remaining two specimens are falling apart. None have any skin left or have unmutated gill openings, branchiostegals, or abdominal cavities. The length of the smallest was apparently about 120 mm, which is much larger than the largest specimen from Oregon (96 mm SL). The OSUO specimens are sexually mature at about 85 mm SL. The discrepancy in size may be the result of avoidance by larger individuals. Possibly the population off Oregon consists of generally smaller individuals because of different environmental conditions than obtain in the Gulf of Panama. I found no anatomical evidence which suggests any differences (other than size) between the two groups of specimens.

DISTRIBUTION.—*Paraliparis latifrons* occurs off Oregon between 2030 and 3025 m, and off Panama in 3279 m. It is probably epibenthic or benthic. I expect more specimens to be captured between the above two localities.

MATERIAL EXAMINED. *Syntypes:* MCZ 28698, sexes unknown, seven specimens, TL 145 mm or less, ALBATROSS sta. 3382, off Panama, 6°21'00"N, 80°41'00"W, 1793 fm (3279 m), 7:III:1891, poor condition.

Other Material. USNM 214613, male, 88 mm SL, BMT 113, sta. CP-1-A, 46°05.1'N, 125°34.6'W, 2156 m, 3:X:1969; MCZ 50979, 50981, male, female, 79, 51 mm SL, BMT 195, sta.



CP-1-A, 45°57.5'N, 125°46.2'W, 2265 m, 20:III:1970; CAS 33206, female, 66 mm SL, BMT 158, sta. CP-2-A, 45°48.3'N, 126°28.2'W, 2651 m, 17:I:1970; OSUO 2312, OSUO uncatalogued, CAS 33205, 33207, three females, male, 85, 50, 74, 76 mm SL, BMT 89, sta. THB 19, 45°44.6'N, 125°26.7'W, 2225 m, 14:VII:1969; OSUO 2314, USNM 214612, male, female, 58, 85 mm SL, BMT 192, sta. CP-1-B, 45°39.8'N, 125°46.5'W, 2450 m, 19:III:1970; OSUO 2313, MCZ 50980, males, 61, 57 mm SL, BMT 193, sta. CP-1-B, 45°39.0'N, 125°52.9'W, 2425 m, 19:III:1970; OSUO 2315, immature, 26 mm SL, BMT 91 MM, sta. CP-1-B, 45°30.4'N, 125°32.5'W, 2377-2483 m, 15:VII:1969; OSUO 2036, female, 96 mm SL, BMT 116, sta. CP-1-C, 45°22.1'N, 125°37.3'W, 2634 m, 4:X:1969; USNM 214614, female, 89 mm SL, BMT 95, sta. CP-1-D, 44°56.1'N, 125°35.3'W, 2706 m, 16:VII:1969.

Comparative Material: *Paraliparis holomelas* Gilbert. Holotype, USNM 48637, sex unknown, 95 mm TL (from original description), ALBATROSS sta. 3332, north of Unalaska Is., 54°02'50"N, 166°45'00"W, 406 fm (743 m), 21:VIII:1890, extremely poor condition.

Paraliparis deani Burke

Paraliparis deani BURKE, 1912a:571 (original description of holotype, USNM 60570; distribution); GILBERT 1915:355 (description; distribution; synonymy; record); JORDAN, EVERMANN, AND CLARK 1930:404 (distribution; synonymy); BURKE 1930:168, fig. 85, 86 (description; distribution; synonymy; in key); SCHULTZ 1936:188 (distribution; in key); SCHULTZ AND DELACY 1936:136, 215 (distribution; synonymy); WILIMOVSKY 1954:287 (distribution); WILIMOVSKY 1958:80 (distribution; in key); CLEMENS AND WILBY 1961:350, fig. 234 (description; distribution; in key); GRINOLS 1965:153 (distribution; synonymy); BAILEY ET AL. 1970:60 (listed); QUAST AND HALL 1972:31 (distribution; references); HART 1973:593, fig. (description; distribution; in key).

Paraliparis holomelas GILBERT: EVERMANN AND GOLDSBOROUGH, 1907:334 (part; specimens from ALBATROSS sta. 4194, 4202, 4251, 4253, 4255, 4292, 4293).

This species is easily separated from the other species known from, or likely to occur in the study area. It has been adequately described by Burke (1912a, 1930:168) and Hart (1973:593). The following expanded diagnosis is sufficient to separate it from the above species.

DIAGNOSIS.—Dorsal fin rays 56–57, anal fin rays 44–48, pectoral fin rays 18–22, caudal fin rays about 6. Mouth horizontal; teeth simple, sharp, with small lobes often present near tip, forming moderately wide band of 20 or fewer

oblique rows of six or fewer teeth each. Gill slit above pectoral fin and extending ventrally in front of about 12 rays. Pectoral fin of 18–22 rays, lower pectoral lobe of five rays, reaching far past anus but not to anal fin origin. Body color pale; peritoneum silvery, dotted with melanophores; stomach black.

DISTRIBUTION.—*Paraliparis deani* is known from Alaska (55–501 m), British Columbia (64–203 m), and northern California (711–1008 m). Although not recorded from Oregon or Washington, I expect certain capture of this species off both coasts. There is an apparent submergence of *P. deani* towards the south. The probable minimum depth of occurrence of *P. deani* off Oregon and Washington should be about 100 meters.

MATERIAL EXAMINED. SU 24974, female, >56 mm SL (broken), shrimp trawl off Petersburg, Alaska, 10–30 fm (18–55 m) ?;VIII:1927; SU 22600, three females, male, 71, 76, 77, >65 mm SL (broken), ALBATROSS near Karluk, Alaska; UW 14761, male, 62 mm SL, COBB drag no. 43 & 44, Stevens Passage, Alaska, 26:III:1951.

Paraliparis dactylosus Gilbert

(Figure 13b)

Paraliparis dactylosus GILBERT, 1895:469, pl. 34 (original description of syntypes, USNM 48616, USNM 53032; distribution); JORDAN AND EVERMANN 1898:2144 (description; distribution; synonymy; in key); GILBERT AND BURKE 1912a:82 (description; record); BURKE 1930:164, fig. 82 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930:404 (distribution; synonymy); SCHULTZ 1936:188 (distribution; in key); SCHULTZ AND DELACY 1936:136, 215 (distribution, synonymy); WILIMOVSKY 1954:287 (distribution); MATSUBARA 1955:1196 (distribution; in key); WILIMOVSKY 1958:80 (distribution; in key); GRINOLS 1965:152 (distribution; synonymy; unverified record); QUAST AND HALL 1972:31 (distribution; references).

DIAGNOSIS.—A primitive *Paraliparis* with strongly lobed teeth in 12–18 oblique rows, gill slit above pectoral fin and extending ventrally in front of two to four rays; pectoral fin of 26–30 rays; and 17–23 pyloric caeca.

DESCRIPTION.

Counts: Dorsal fin rays 56 (54–56), anal fin rays

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FIGURE 13. (a) *Paraliparis latifrons* Garman, CAS 33206, female, 66 mm SL, from off Cape Falcon, Oregon. (b) *Paraliparis dactylosus* Gilbert, OSUO 2263, female (partially skinned), 121 mm SL, from off Cape Mendocino, California. (c) *Paraliparis pectoralis* Stein, new species. Holotype, USNM 214606, male (partially skinned), 135 mm SL, from off Tillamook Head, Oregon. (d) *Paraliparis ulochir* Gilbert, BCPM 71-194, female (completely skinned), 102 mm SL, from off Tillamook Head, Oregon. (e) *Paraliparis megalopus* Stein, new species. Holotype, USNM 214616, female (partially skinned), 150 mm SL, from off Florence, Oregon. Illustrations drawn by Paul Iwanaga.

50 (49–51), pectoral fin rays 29 (28–30), caudal fin rays 8. Pyloric caeca 20 (17–22). Vertebrae 60 (59–61). Maxillary tooth rows 12–18. Cephalic pores 2–6–7–?.

Morphometry: Head length 22.0 (19.0–23.0) % SL, body depth 18.5 (17.0–20.7), eye length 5.8 (5.2–6.7); body depth 89.9 (78.2–94.9) % head length, mandible-anus 64.9 (53.4–78.1), lower pectoral fin-lobe length 90.0 (87.6–94.4), maxillary length 38.6 (36.3–42.4).

Head blunt, snout distinctly protruding; dorsal profile rising evenly to occiput, interorbital space flat. Eyes large, black. Nostrils single, short, tubular, on horizontal with lower portion of pupil; close to eye. Maxillary reaching below or slightly posterior to vertical through rear of pupil, oral cleft reaching below pupil. Teeth in 12–18 oblique rows of up to six teeth each, forming moderately wide band in premaxillary, a slightly narrower band present on mandible. Outer and posterior teeth simpler, smaller; those nearest symphysis of jaw largest, with obvious lobes. Gill slit above pectoral fin and extending ventrally in front of two to four rays. Opercular flap supported by blunt, single spine.

Upper pectoral fin ray even with lower margin of orbit; ventral pectoral base curved sharply anterior. Upper pectoral fin lobe of 12–15 rays, slightly shorter ventrally, almost reaching anal origin. Notch in fin of moderate depth, not nearly reaching cleithrum. Rays of notch five to ten, spacing gradually increasing ventrally; rays not always distinct from those of upper pectoral lobe. Lower lobe longer than upper; of six rays, fourth and fifth rays longest, reaching more than half way to anal origin. Symphysis of lower pectoral lobes below pupil, prominent; a broad fold of skin present between lobes.

Body tapering evenly to caudal fin, not very attenuate, posterior portion of body relatively stout. Anal fin origin anterior to midpoint between gill opening and posterior margin of orbit. Anal papilla present in both sexes. Dorsal fin origin behind or even with vertical through tip of opercular spine. Caudal overlapped about one fourth by vertical fin rays. Skin transparent, thin; rudimentary pores absent.

Stomach located left dorsally in body cavity. Pyloric caeca moderately long, stout.

Body color of preserved specimens pale anteriorly, scattered melanophores present on skin and body; caudal fin and posterior of dorsal and anal fins blackish. Oral and branchial cavities

black, peritoneum black; stomach and pyloric caeca pale.

RELATIONSHIPS.—*Paraliparis dactylosus* is not closely related to any known *Paraliparis* but is very similar to *Elassodiscus caudatus* from which it differs in the absence of the disk, pale stomach (vs. black stomach), more vertical fin rays (dorsal rays 54–56 vs. 49–55; anal rays 49–51 vs. 45–50), and fewer rows of teeth (12–18 vs. 25–29 rows).

REMARKS.—The OSU specimens differ from Burke's (1930:164) description in several significant respects, notably number of maxillary tooth rows (12–18 vs. 7–8); dorsal, anal, and pectoral fin-ray number; and number of pyloric caeca. I have examined the syntype described by Burke (USNM 48616), which is in poor condition, and have found his description inaccurate in several particulars. There are 13–14 rows of teeth in the maxillary, not eight as stated; and 22 or 23 pyloric caeca, not 13. Fin ray counts could not be made because of the poor condition of the specimen. However, Gilbert (1895), in the original description, stated, "pectoral rays 30. . . Dorsal ca. 56. . . Anal ca. 46." Burke (loc. cit.) states that there were 33 pectoral rays, 64 dorsal rays, and 59 anal rays; he also states that the type was mutilated at the time of his examination. A specimen from ALBATROSS station 4781, probably USNM 74720 (the collection number is not given in the description), was also examined by Burke, and its counts and measurements included in the description of *P. dactylosus*. Although Burke (loc. cit.) says, "a specimen from station 4781. . . is doubtfully placed with this species;" he also states, "apparently differs in no essential respect from the type, although a close comparison between the two specimens has not been made." This specimen, also examined by me, differs from the syntypes in having seven to eight rows of maxillary teeth, and from the original description in having 64 dorsal, 59 anal, and 34 pectoral fin rays. I believe that this specimen should not presently be considered *P. dactylosus*, and that many of its characters may have been used by Burke to replace those which may have been unobtainable from specimen no. 48616.

DISTRIBUTION.—*Paraliparis dactylosus* occurs between 541 and 960 m from the Bering Sea and Aleutian Islands to Oregon and central California.

MATERIAL EXAMINED. *Lectotype*: USNM 48616, sex unknown, about 46 mm SL, ALBATROSS sta. 3112, off Santa Cruz, California, 37°08'00"N, 122°47'00"W, 296 fm (541 m), 12:III:1890, very poor condition.

Paralectotypes: USNM 53032, sex unknown, about 90 mm SL, and SU 3024, female, 60 mm SL, poor condition, both with same data as for lectotype.

Other Material: OSUO 2262, male, 89 mm SL, BMT 394, sta. CBT 310 C, 43°28.0'N, 124°50.0'W, 550 m, 14:VIII:1974; OSUO 2261, male, 81 mm SL, BMT 366, sta. CBT 310 D, 43°25.9'N, 124°51.5'W, 658 m, 4:VII:1974; OSUO 2263, female, 121 mm SL, CSUH OTB off Cape Mendocino, California, 40°11'37"N, 124°57'30"W, 960 m, 26:I:1973.

***Paraliparis pectoralis* new species**

(Figure 13c)

DIAGNOSIS.—A *Paraliparis* with mouth horizontal; teeth simple or arrow-shaped canines in narrow bands. Upper pectoral fin ray on a horizontal through posterior of maxillary; pectoral fin rays 29–32.

DESCRIPTION.

Counts: Dorsal fin rays 57 (55–58), anal fin rays 49 (49–52), pectoral fin rays 31 (29–32), caudal fin rays 8 (7–8). Pyloric caeca 9 (9–10). Vertebrae 63–64 (10–11 + 52–54). Cephalic pores 2–?–?–?.

Morphometry: Head length 19.8 (18.9–21.0) % SL, body depth 17.8 (15.8–19.1); body depth 90.2 (75.2–101.2) % head length, upper pectoral fin-lobe length 83.1 (64.6–92.9), lower pectoral fin-lobe length 62.1 (52.6–72.6), mandible to anus 64.8 (58.8–66.6), maxillary length 47.5 (44.5–51.4).

Head and body dorso-ventrally compressed. Head profile evenly rounded, mouth slightly inferior. Occiput not swollen. Eyes black, prominent. Upper orbital margins well below lateral profile of interorbital space. Nostrils single, with prominent raised rim, anterior to eye a distance equal to about one-half eye diameter. Maxillary extending posteriorly to below rear of eye or orbit. Mandibular symphysis prominent, usually appearing as sharp angle at tip of mandible. Teeth simple, blunt canines or slightly lanceolate; in very irregular rows which form a narrow band in each jaw, nowhere more than three teeth wide; band narrows posteriorly and becomes uniserial. Prominent gap in teeth at premaxillary juncture, a much narrower gap present at mandibular symphysis. Cephalic pores with anterior pores enlarged, posterior pores smaller. Gill slit located above pectoral fin and extends ventrally anterior to one or two rays. Opercular flap triangular posteriorly; tip of flap on or below horizontal line through ventral margin of orbit.

Pectoral fin bilobed, notch evidently deeper in smaller specimens. Upper pectoral fin ray at or above level of posterior of maxillary. Upper pectoral lobe slightly longer than head, of 14–19 rays, not always easily distinguished from rays of notch. Rays of notch usually more widely spaced than those of upper lobe, but in some individuals, ray spacing increases gradually towards lower pectoral lobe, not distinct from upper lobe. Lower pectoral fin lobe always distinct, rays 5–7, closely spaced, increasing in length dorsally. Pectoral fins extend ventrally anterior to vertical through anterior margin of orbit, a noticeable gap separating lower lobes.

Body tapers gradually to caudal fin, only slightly attenuate; caudal about one-half confluent with dorsal and anal fins. Dorsal fin origin about over gill slit, anal fin origin below about sixth dorsal ray. Anterior dorsal fin rays short, partially but not completely embedded in flesh. Skin very thin, fragile. Rudimentary pores present along lateral line, evenly spaced, evidently not present anywhere else on body.

Stomach and pyloric caeca located left ventrally in body cavity. Pyloric caeca of moderate length, plump, pointed.

Skin dark brown; head darker; melanophores scattered over body; mouth, branchial cavity, and peritoneum black. Stomach and pyloric caeca pale.

ETYMOLOGY.—The specific name *pectoralis*, after the pectoral fin which forms the main distinction between this and other species.

RELATIONSHIPS.—*Paraliparis pectoralis* is most similar to *P. angustifrons*. The syntypes of *P. angustifrons* are in extremely poor condition, with the heads broken off and most of the fins missing. Although *P. angustifrons* was described as having an oblique mouth, the original illustration shows only a slightly oblique mandible, which appears similar to that of *P. pectoralis*. I could not determine the accuracy of the portrait from the specimens. However, *P. pectoralis* differs significantly from *P. angustifrons*; it has fewer pectoral rays (29–32 vs. 37) which are more widely spaced in the notch than in the pectoral fin lobes (*P. angustifrons* has evenly spaced rays throughout the pectoral), and much larger teeth (those of *P. angustifrons* are relatively about one-half as large).

DISTRIBUTION.—*Paraliparis pectoralis* occurs off the coast of Oregon between 1097 and 1536 m. It is apparently benthopelagic.

MATERIAL EXAMINED. *Holotype*: USNM 214606, male, 135 mm SL, off Tillamook Head, Oregon, 45°50'N, 125°06'W, 840 fm (1536 m), 16:XI:1966.

Paratypes: OSUO 2286, 2287, females, 106, 93 mm SL, 46°09'N, 124°45'W, 600–710 fm (1097–1298 m), 15:VI:1966; CAS 33200, OSUO 2301, females, 86, 76 mm SL, AEC sta. 29A, off the Columbia River, 750 fm (1372 m), 14:V:1963; BCPM 71–203, female, 71 mm SL, AEC sta. 24, 45°35'N, 124°53'W, 750 fm (1372 m), 28:V:1964; USNM 214607, males, 165, 151 mm SL, 45°50'N, 125°06'W, 840 fm (1536 m), 16:XI:1966.

Comparative Material: *Paraliparis angustifrons* Garman. Syntypes, MCZ 28699, two specimens, sex unknown, SL unknown (4.5 inches *fide* original description), ALBATROSS sta. 3394, 7°21'00"N, 79°35'00"W, 511 fm (935 m), 10:III:1891, very poor condition.

***Paraliparis ulochir* Gilbert**

(Figure 13d)

Paraliparis ulochir GILBERT, 1895:441 (original description of syntypes, SU 2481; distribution); JORDAN AND EVERMANN 1898:2144 (description; distribution; synonymy; in key); EVERMANN AND GOLDSBOROUGH 1907:334 (distribution); GILBERT 1915:354 (record); BURKE 1930:171, fig. 89 (description; distribution; synonymy; in key); JORDAN, EVERMANN, AND CLARK 1930:405 (distribution; synonymy); SCHULTZ 1936:188 (distribution; in key); SCHULTZ AND DELACY 1936:136, 215 (distribution; synonymy); WILIMOVSKY 1954:287 (distribution); GREY 1956:226 (distribution; synonymy); WILIMOVSKY 1958:80 (distribution; in key); GRINOLS 1965:154 (distribution; synonymy; unverified record).

DESCRIPTION.—The Oregon specimen fits the description given by Burke (1930:171) well, with the following additions:

Counts: Dorsal fin rays about 69, anal fin rays 61, pectoral fin rays 24, caudal fin rays 4.

Morphometry: Head length 20.0% SL, body depth 19.6, mandible to anus 63.4; eye length 26.8% head length, maxillary length 36.1, upper pectoral fin-lobe length 66.8; upper pectoral fin-lobe length 75.7% lower pectoral fin-lobe length.

Head blunt, snout short, rising abruptly to level of pupil, then sloping evenly to slightly swollen occiput. Interorbital space flat. Eyes large; orbits almost intruding into interorbital space, nearly reaching dorsal profile of head. Mouth small, maxillary reaching below rear of pupil, cleft reaching below front of pupil. Mouth terminal, posteroventral portion of articular sharply angled. Teeth very slender, lanceolate; in both jaws about 16 oblique rows of no more than seven teeth each, forming moderately wide band which narrows posterolaterally. Inner teeth larger than outer; teeth size increases rapidly toward inside of mouth. Narrow gaps in tooth bands present at premaxillary and mandibular symphyses. Oper-

cular flap sharply pointed, supported by two posteriorly curved spines; upper spine shorter, stout; lower spine slender, following curve of upper. Gill slit above pectoral fin, very short, not much longer than diameter of pupil.

Pectoral fin distinctly notched; upper ray even with dorsal margin of pupil, almost beneath tip of lower opercular spine. Upper lobe of nine closely spaced rays, reaching past anal fin origin. Rays in notch six, distinct from both upper and lower lobes, ventrally very widely spaced; Gilbert (1895) states, "None of the rays are free." Lower pectoral fin lobe of nine closely spaced rays, none free.

Body tapers evenly to caudal fin, dorsal fin origin above opercular spine. Anus below interopercle.

Stomach and pyloric caeca located left dorsally in body cavity. Pyloric caeca stout, blunt.

Skin color evidently black in life, oral and branchial cavities black, peritoneum and stomach black; pyloric caeca pale.

RELATIONSHIPS.—See *Paraliparis megalopus*.

DISTRIBUTION.—*Paraliparis ulochir* evidently occurs on the continental slope of the west coast of North America from Baja California to the Bering Sea, between 700 and 1900 m. In the future, more specimens will probably be captured off northern California, Washington, and British Columbia.

MATERIAL EXAMINED. *Syntypes*: SU 2481, male?, female, about 69, 80 mm SL, ALBATROSS sta. 3010, Gulf of California, 27°23'45"N, 111°25'00"W, 1005 fm (1838 m), 20:III:1889, poor condition.

Other Material: USNM 48699, sex undetermined, SL unknown, ALBATROSS sta. 3332, 54°02'50"N, 166°45'00"W, Bering Sea, 406 fm (743 m), 21:VIII:1890; BCPM 71–194, female, 102 mm SL, off Tillamook Head, Oregon, 45°54'N, 125°05'W, 1554 m, 15:V:1963.

***Paraliparis megalopus* new species**

(Figure 13e)

DIAGNOSIS.—A *Paraliparis* with opercular opening above or slightly in front of pectoral fin; uppermost pectoral fin ray even with pupil; pectoral fin rays 16–19, very widely spaced in notch, free for about one-half of their length; stomach black.

DESCRIPTION.

Counts: Dorsal fin rays 68 (66–71), anal fin rays 65 (63–65), pectoral fin rays 18 (16–19), caudal fin rays 4. Pyloric caeca 7 (6–8). Vertebrae about 76 (9 + 67). Cephalic pores 2–6–7–1.

Morphometry: Head length 18.8 (17.0–20.4) % SL, body depth 17.7 (15.3–21.0); body depth 94.2 (84.1–111.2) % head length, head width 64.4 (55.9–76.3), upper pectoral fin-lobe length 78.9 (75.3–85.0), lower pectoral fin-lobe length 67.9 (52.3–89.4), eye length 28.8 (22.6–34.8), maxillary length 40.0 (36.2–43.6), snout to anus 88.6 (84.1–93.4), mandible to anus 75.5 (66.1–82.6).

Head deep, dorso-ventrally compressed; snout very blunt, almost vertical; rounded lateral profile rising abruptly to very swollen occiput, especially in largest specimens. Eyes very large, round. Nostrils single with slightly raised rim; close to eye, on horizontal through center of pupil. Mouth small, posterior of maxillary reaching below rear of eye, cleft reaching below front of eye. Teeth simple, slightly recurved canines with stout bases, in narrow bands on each jaw, composed of 17–18 oblique rows of up to seven teeth each on premaxillary, about 15 oblique rows on mandible. Outer teeth smallest, increasing gradually in size towards inside of mouth. Articular with sharp posteroventral angle. Narrow gaps in tooth bands present at premaxillary and mandibular symphyses. Symphyseal knob present on mandible. Cephalic pores slightly enlarged, not obvious; supraocular pores much smaller than other cephalic pores. Gill slit wholly above pectoral fin or extending ventrally anterior to one or two pectoral rays. Opercular flap triangular, supported by a single spine.

Pectoral fin distinctly notched; upper pectoral ray even with or above horizontal through pupil. Upper pectoral lobe reaching well behind anal fin origin, of 10 or 11 closely spaced rays. Rays of pectoral notch two to six, long, very widely separated, free for at least one-half their length. Lower pectoral fin-lobe rays three to five; increasing evenly in length dorsally, reaching past anus but not to anal origin; closely spaced, distinct from notch rays, free for most of their length with slightly more webbing than more dorsal fin rays.

Body deep, dorso-ventrally compressed. Dorsal fin origin about over gill slit, anal origin below about fifth dorsal ray. Anterior dorsal fin rays not buried in flesh, gradually longer posteriorly. Anus between lower pectoral fin lobes, anterior to vertical through posterior of pectoral fin base. Body tapering slowly and evenly from occiput to caudal fin, somewhat attenuate posteriorly. Caudal fin connection with dorsal and anal fins unclear. Skin thin, fragile; rudimentary pores

present on lateral line, evenly spaced, also scattered over anterior of body and occiput.

Stomach and pyloric caeca located left dorsally in body cavity; pyloric caeca very thick, slightly pointed.

Body color tan or dark brown posteriorly; blackish on head. Mouth, branchial cavity, peritoneum, stomach, and pyloric caeca black.

RELATIONSHIPS.—*Paraliparis melanobranchus* most closely resembles *P. megalopus*, but it has smaller, more closely spaced teeth in wide bands; its upper orbital margin does not reach the dorsal profile of its head at the interorbital space, and it has a less swollen occiput and larger cephalic pores. Its pectoral fin ray spacing gradually increases ventrad, while in *P. megalopus* the pectoral fin notch rays become abruptly farther apart. In *P. melanobranchus*, the rays are webbed almost to the tip, while in *P. megalopus*, they are at least half free. In *P. melanobranchus* the anus is very close to the pectoral symphysis while in *P. megalopus* it is noticeably distant.

Paraliparis fimbriatus (Garman, 1892) also resembles *P. megalopus*, especially in having the intermediate pectoral fin rays prolonged, but it differs in having more pectoral fin rays (24 vs. 16–19), which are closely and evenly spaced, with both the upper and lower lobes indistinct. It also has a larger mouth, and a head width equal to head depth (vs. *P. megalopus* head width 64.4% head length).

Paraliparis ulochir superficially resembles *P. megalopus* but has a lower pectoral fin lobe of nine (vs. three) rays, a higher pectoral ray count (24 vs. 16–19), and the pectoral notch rays and lower pectoral lobe rays are not free (vs. free rays of *P. megalopus*).

DISTRIBUTION.—*Paraliparis megalopus* is known only from Cascadia and Tufts abyssal plains off Oregon, between 2830 and 3585 m. In the future, it will probably be captured off California and Washington.

ETYMOLOGY.—From the Greek *μεγαλωήος*, (*megalopus*), large eyed.

MATERIAL EXAMINED. *Holotype*: USNM 214616, female, 150 mm SL, BMT 291, sta. CP-1-WW, 44°04.0'N, 125°23.8'W, 2940 m, 15:VI:1972.

Paratypes: USNM 214617, female, 137 mm SL, BMT 408, sta. CP-3-E, Cascadia Channel, 44°40.0'N, 127°22.9'W, 3045 m, 2:VIII:1974; OSUO 2317, female, 152 mm SL, OTB 155, sta. NH-65, 44°35.8'N, 125°34.3'W, 2830 m, 10:1:1967; CAS 33209, female, 121 mm SL, BMT 288, sta. CP-1-WW, 44°06.2'N, 125°22.7'W, 2940 m, 14:VI:1972; CAS 33211, CAS 33210, males, 107 mm SL, 139 mm SL, BMT 291, sta. CP-1-WW, 44°04.0'N, 125°23.7'W, 2940 m, 15:VI:1972.

***Paraliparis melanobranchus* Gilbert and Burke**

Paraliparis melanobranchus GILBERT AND BURKE, 1912b:378, pl. 48, fig. 2 (original description of holotype, USNM 73346; distribution); BURKE 1930:173, fig. 90 (description; distribution; synonymy; in key); SCHMIDT 1950:214 (distribution); MATSUBARA 1955:1196 (distribution; in key); UENO 1971:98 (distribution); QUAST AND HALL 1972:32 (distribution; references).

Paraliparis melanobranchis ALTON, 1972:591, 610 (misspelling; unverified record).

DIAGNOSIS.—A species distinguished from other *Paraliparis* by the gill slit wholly above pectoral fin of 17 rays, the spacing of which increases gradually ventrad; only tips of pectoral fin notch rays free; 60 dorsal fin rays and 53 anal fin rays.

Complete descriptions are included in Gilbert and Burke (1912b) and Burke (1930:173). A very short description follows.

DESCRIPTION (figures in parentheses from original description).

Counts: Dorsal fin rays (60), anal fin rays (53), pectoral fin rays 17, upper pectoral fin lobe of 13 rays, lower pectoral fin lobe of 4 rays, caudal fin rays 4.

Morphometry: Head length 22.0% SL, body depth (21.0), snout to anus (13.0) eye length (6.0), longest rays of upper pectoral fin lobe (13.0), longest rays of lower lobe (11.0); maxillary length 44.3% head length.

RELATIONSHIPS.—This species is close to *P. megalopus*. See that species for a discussion of the differences.

REMARKS.—*Paraliparis melanobranchus* is included here because there are two unverified records from Oregon (Alton 1972:610). I have been unable to find those specimens. The only other specimen which has been recorded is the holotype. I believe the Oregon records to be of doubtful validity because of the distance from the Sea of Okhotsk, the limited distribution of many Sea of Okhotsk deep-water species, and the difference between the depths of capture of the holotype (805 m) and the Oregon specimens (1453–1554 m).

DISTRIBUTION.—*Paraliparis melanobranchus* is known from the southern Sea of Okhotsk (Gilbert and Burke 1912b) and two unverified records from Oregon in 1463 and 1554 meters (Alton 1972:610).

MATERIAL EXAMINED. *Holotype:* USNM 73346, female, 76 mm SL, ALBATROSS sta. 5029, southern Okhotsk Sea, 48°22'30"N, 145°43'30"W, 440 fm (805 m), 28:IX:1906.

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ADDENDUM

A paper, in Russian, describing a new genus and species of liparid, *Genioliparis lindbergi* Andriashev and Neelov, was received too late for discussion in the body of this paper. A translation prepared for me has been deposited at CAS. It is cited as: Andriashev, A. P. and A. V. Neelov

1976. *Genioliparis lindbergi*, ge. et sp. n.—A new fish of the family of sea slugs (Liparidae) from the bathic depth of the Antarctic. Pages 68–77 in V. M. Korovina, ed., *Zoogeography and systematics of fishes*. Zool. Inst. Acad. Sci. Leningrad.

Genioliparis lindbergi appears to be remarkably similar to *Odontoliparis ferox* n.gen., n.sp., described herein. The counts of the dorsal, anal, pectoral, and caudal fin rays are similar, as are the vertebral counts and number of pyloric caeca. Its general appearance and the character of its dentition are also similar. The major differences between the two species appear to be in the lack of mandibular and internareal papillae in *Genioliparis*, its possession of body prickles, a massive lower jaw, and different head-length and body-depth proportions. Other differences lie in the number of cephalic pores, and the color of the

membranes lining the abdominal, oral and branchial cavities.

Genioliparis lindbergi and *Odontoliparis ferox* appear to be very similar and closely related or morphologically convergent. Traditionally, differences in the presence or location of cephalic papilla have been considered as important in distinguishing liparid genera. The differences shown by the only two specimens known of these genera are not sexually dimorphic or the result of allometric growth, because both individuals are females of about the same size. Because of the papilla differences, the few specimens known, and the widely separated localities of collection, I consider *G. lindbergi* and *O. ferox* as members of two different genera, although I recognize that further study may require modification of my present opinion.